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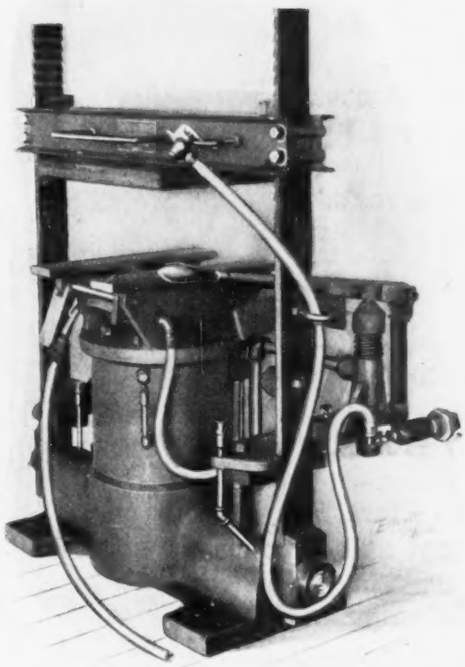

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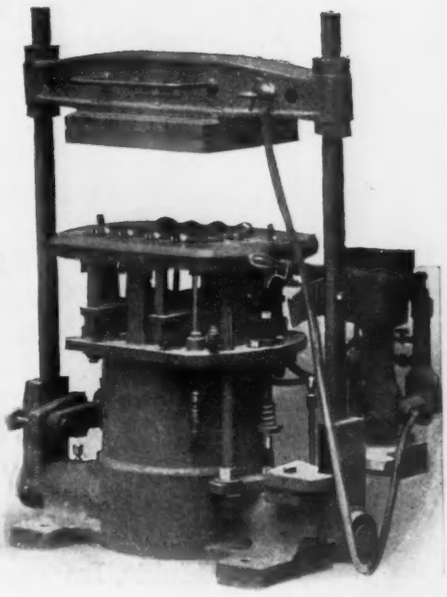

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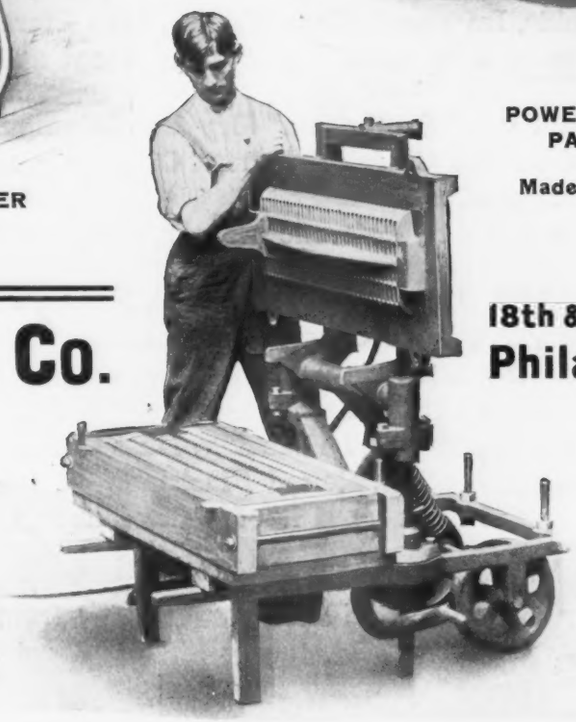

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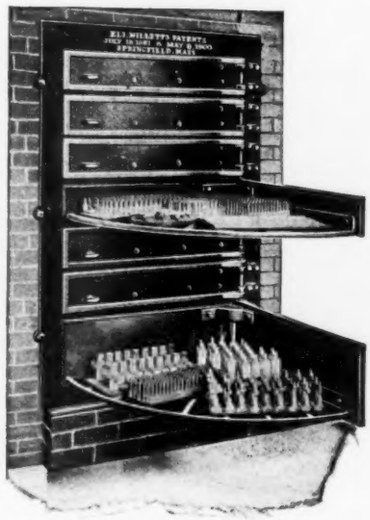

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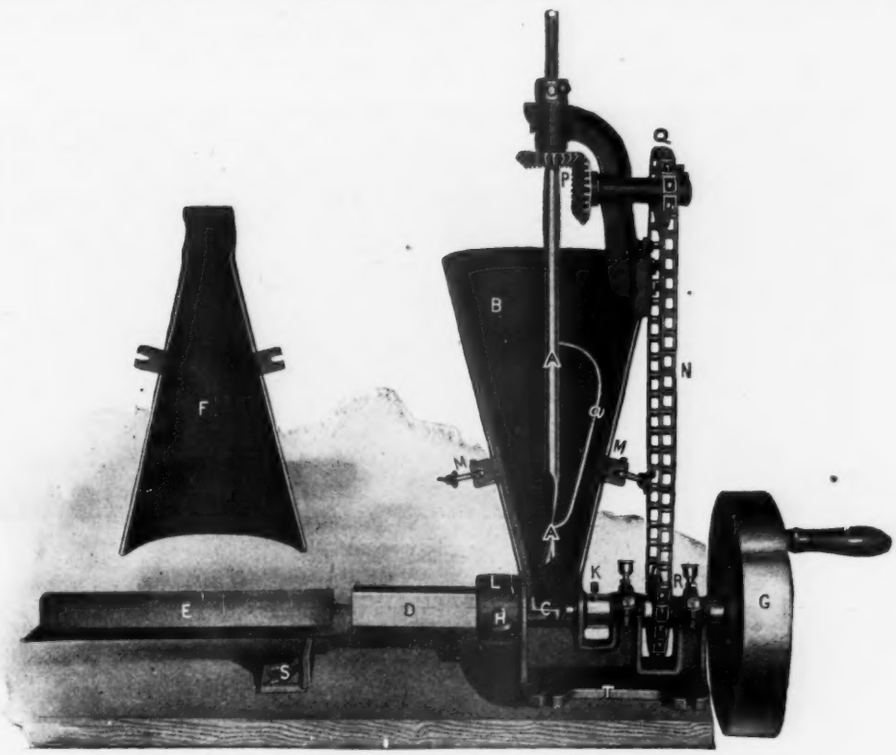

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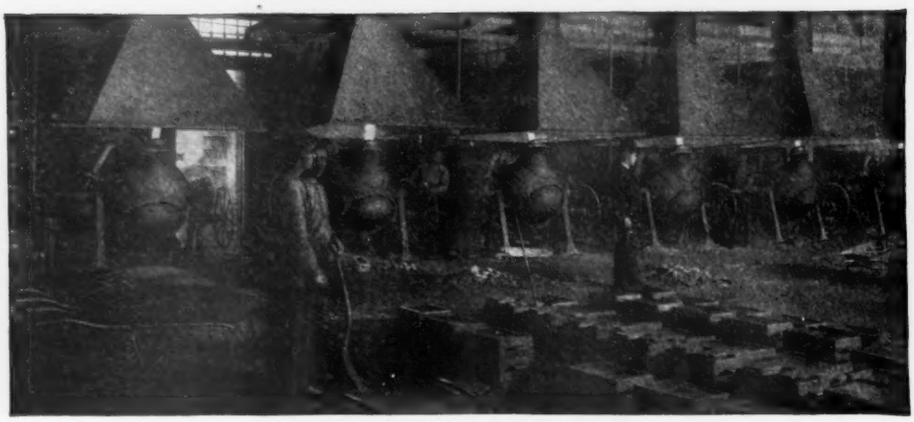

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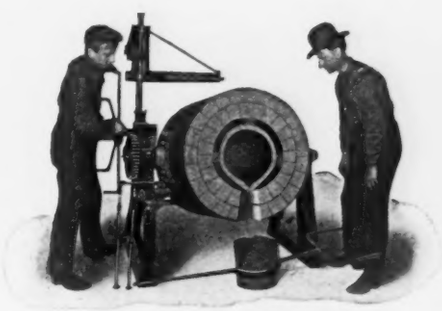

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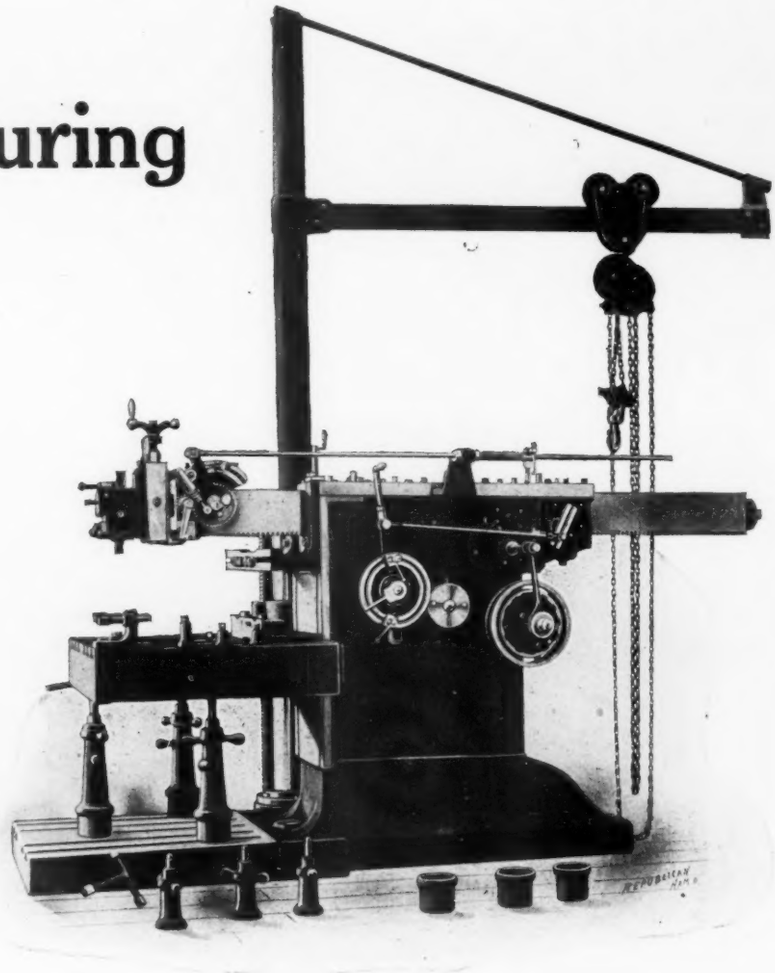

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THE FOUNDRY

Vol. 31, No. 3 CLEVELAND, OHIO, NOVEMBER, 1907 Whole No. 183

PRODUCTION OF MALLEABLE FITTINGS

Methods of Manufacture Practised at the New Plant of the Morse Iron Works, Erie, Pa.

THE malleable casting industry has recorded a greater proportionate growth during the last twelve months than any other branch of the foundry trade, and while many extensions have been made to existing plants, the number of new works erected during this period establishes a new high record. Although the bulk of the new tonnage will be consumed by the railroads and makers of agricultural implements, a large portion of the increased output will consist of pipe fittings.

New Works at Erie.

One of the largest and most complete plants recently erected for the manufacture of this line has been built during the year by the Morse Iron Works, Erie, Pa. It includes not only a large and commodious foundry, but a machine shop for finishing the castings, and wood and metal pattern departments devoted exclusively to the company's work. The daily malleable output averages about 10 tons. A cupola has been installed for gray iron fittings and other castings that are required from time to time in a plant of this kind.

Layout of the Plant.

Built on a tract of 17 acres, ample room has been provided for future extensions, and the foundry and machine shop, have been so designed that additions can be made at either end without disturbing the present arrangement of the equipment. The buildings parallel the main line of the New York, Chicago & St. Louis railroad, and are of brick construction with steel roof supports. A spur from the Lake Shore & Michigan Southern railroad also enters the plant, and between the foundry and machine and pattern shops a track has been laid for outgoing shipments. The buildings all have a uniform height of 20 feet to the bottom of the roof trusses. The roofs are all of the saw toothed type, the apex of the teeth having a height of 32 feet above the floor level. The saw teeth extend the width of the building and are each 24 feet wide. On one side of each saw tooth there are 24 swinging sashes, and when the windows are opened, the ventilation is ample, even in the foundry.

Foundry.

The foundry is 100 x 192 feet. The malleable iron is melted in one air furnace, which is located at one side of the plant, about midway between the cupola and the annealing furnace. This arrangement provides ample molding room on either side of the furnace, and as the iron is tapped from both sides, very little time is required for tapping out the heat. All patterns which can be economically mounted on pattern plates are molded on a Berkshire molding machine, installed by the Berkshire Mfg. Co., Cleveland. The machine has a capacity for plates up to 12 x 18 inches in size. The sand mixer has been erected on a platform immediately above the machine which prepares the sand not only for

FIG. 1—BERKSHIRE MOLDING MACHINE.

FIG. 2—ANNEALING FURNACE

the molding machine but for the core department and the bench molders as well. The sand mixer is equipped with a swinging spout which delivers the sand to the boot of the Berkshire machine, and can also be swung aside for discharging the sand on the floor for distribution to the other departments.

For special work and odd sizes of fittings, match boards are used almost exclusively, although practically all standard fittings are mounted on the pattern plates. The composition boards used at this plant consist of sand, pure linseed oil and litharge. The ordinary molding sand used in the foundry is dried and passed through a fine mesh riddle, then tempered with linseed oil to the consistency required for molding, and several tablespoonfuls of litharge are added to each pint of oil to facilitate the drying. With careful handling these boards can be used for months. The molding machine and sand mixer are shown in Fig. 1.

Cupola.

The cupola and charging floor are located in a lean-to 25 x 48 feet, as shown in the general plan of the foundry, Fig. 3. Raw material is received over an elevated track which connects with the New York, Chicago & St. Louis railroad. The coke is unloaded directly onto the charging floor, which is on a level with the elevated track, and other material, including pig iron, coal, scale, scrap, etc. is unloaded and dropped into bins directly underneath the track. Charges for the cupola are made up in the storage yard and are raised to the charging floor by an elevator. The cupola has an inside diameter of 36 inches and was furnished by the J. W. Paxson Co., Philadelphia. The blast is furnished by a No. 4 Green positive pressure blower, installed by the Wilbraham-Green Blower Co., Philadelphia.

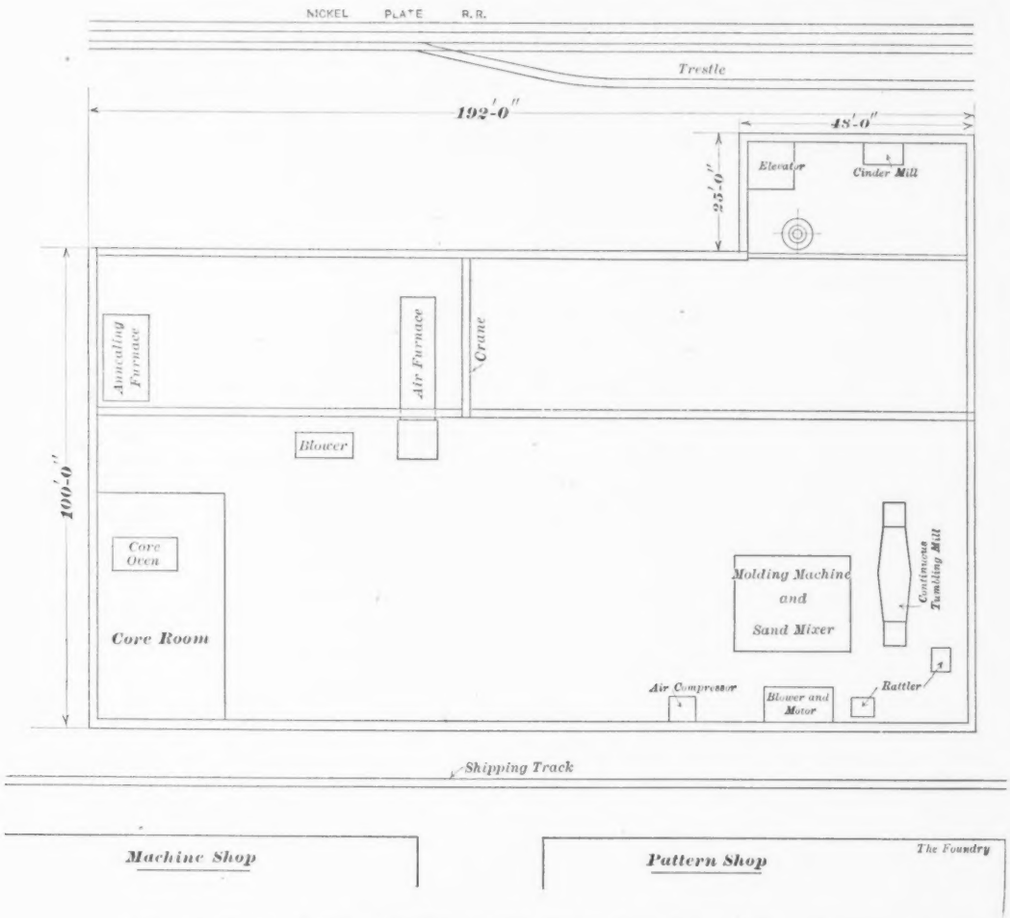


FIG. 3—PLAN OF THE FOUNDRY OF THE MORSE IRON WORKS, ERIE, PA.

Air Furnace.

The air furnace, shown in Figs. 7 and 9, is 35 feet long, has an inside width of five feet, and a capacity of 10 tons. As compared with the furnaces generally in use in malleable plants, the design has been modified in only a few details. The air blast, as in most furnaces of this kind, is not introduced directly over the bridge wall, but at a point above the two tapping spouts. This not only facilitates the melting, but also produces the hottest iron at the point in the furnace where it is most desired when the heat is being poured. The arch of the roof also shows some modifications, and these lines have produced excellent results. The furnace has two charging doors on either side, and air blast is introduced into the ash pit underneath the grate through a 12-inch pipe. The blower which furnishes the blast is located close to the furnace, the blast main being carried underground. The roof bungs, Fig. 6, also extend over the grate, which is not arched over with brick work. The latter type of construction is followed in many plants. The bungs rest on steel angles placed on the outside corners of the side walls which prevent the brick work of the crown from coming in contact with that of the side walls. A 5-ton electric traveling crane having a 33-foot span and which operates the length of the foundry is used for raising the bungs into position over the furnace. The crane was installed by the Northern Engineering Works, Detroit. The furnace is so located that raw material

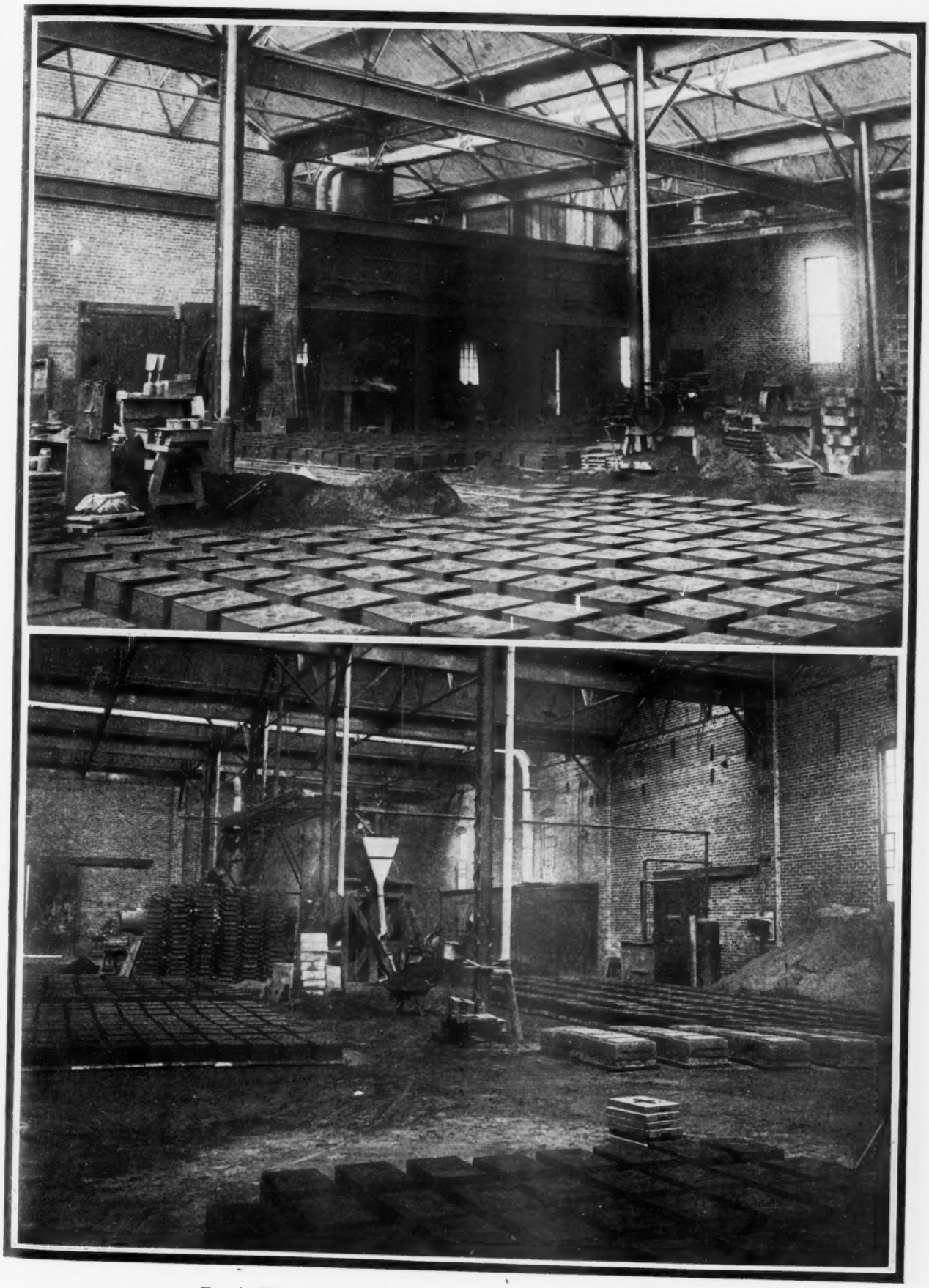


FIG. 4—VIEW OF THE FOUNDRY WITH CUPOLA IN THE BACKGROUND
FIG. 5—MACHINE MOLDING FLOOR

must be carried only a short distance from the storage yard.

Annealing Furnace.

The annealing furnace, shown in Figs. 2 and 13, designed for the use of either coal or producer gas as fuel, is 18 feet long, 17 feet wide and has an inside height of 8 feet. It is provided with three fire doors. The charging truck is of the ordinary type generally used in malleable plants, although it is now being rapidly replaced in large works by a pneumatic charging buggy which can be operated by one man. At present the annealing furnace is operating on coal, but as soon as the new producer plant is completed, gas will be used. Rolling mill scale is used entirely for charging the boxes.

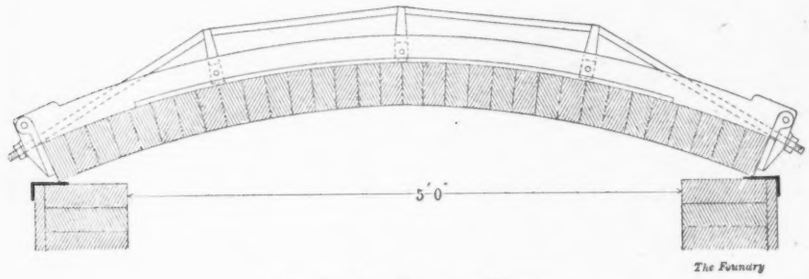


FIG. 6—AIR FURNACE BUNG

Cleaning Equipment.

The cleaning is done by two small and one continuous tumbling mill, installed by the W. W. Sly Mfg. Co., Cleveland, which also furnished the cinder mill located underneath the charging floor. The continuous mill, Fig. 11, is 24 feet long, is slightly inclined toward its discharge end and is mounted on a substantial base built of structural steel shapes. This mill exhausts at the center and the dust is carried outside of the foundry. By the use of this mill, the time required for cleaning the castings is greatly reduced. The mill is operated by a motor driven shaft. The motor has a capacity of 20-horsepower, has a swivel base and can be swung around for operating the cupola blower when required. By this arrangement, however, the tumbling mills are idle while the blast is on. The blast pipe from the blower is carried overhead to the cupola, a distance of about 100 feet. The sand mixer, installed by the Standard Sand & Machine Co., Cleveland, is driven by a 10-horsepower motor, and an air compressor, installed by the Bury Compressor Co., Erie, for operating the Berkshire Molding Machine is located in an enclosed pit underneath the foundry floor. The cupola blower and motor are located in a dust proof room.

A space approximately 25 x 50 feet is set apart for the core department. It is provided with a core oven 6 x 6 x 6 feet, divided into three compartments. Two of these are fitted with five shelves each, which have drop doors at either end. By this arrangement, the green cores are placed into the ovens at one end and when baked are removed at the other. The other compartment is for large cores. Each section is separately fired, and any or all of the compartments can be utilized as desired.

Pattern Shop.

The office and the wood pattern shop are located in one building, 100 x 48 feet. The equipment of wood working tools for the patternmakers is adequate for a plant of this kind. All the machines are belt-driven from a center shaft, which is operated by a 12-horsepower motor. Guards have been placed around the belts and saws as shown in Fig. 12. The patterns are being temporarily stored in a loft above the shop, until a suitable storage can be built.

Machine Shop.

The machine shop, Fig. 10, is 100 x 48 feet. The power plant and metal pattern department are located in one end of this building. The tapping machines for finishing fittings are the invention of Thomes G. Morse, vice president and general manager of the company, and have all been built in this shop under his supervision. They are driven by individual motors, and include one six spindle machine for tapping two ¾ to 1¼-inch tees at each operation; one eight spindle machine for tapping four ¾ to 1¼-inch elbows at each operation, and one six spindle machine for tapping two 1½-inch to 2½-inch elbows at each operation. A Landis bolt cutter is provided for threading plugs, bushings, etc. The other machine tool equipment consists of lathes, drills, shapers, gear cutters, boring mills, pipe cutters, milling machines, etc. As all of the tapping machines are being built by the company, the machine tool equipment is larger than would be or-

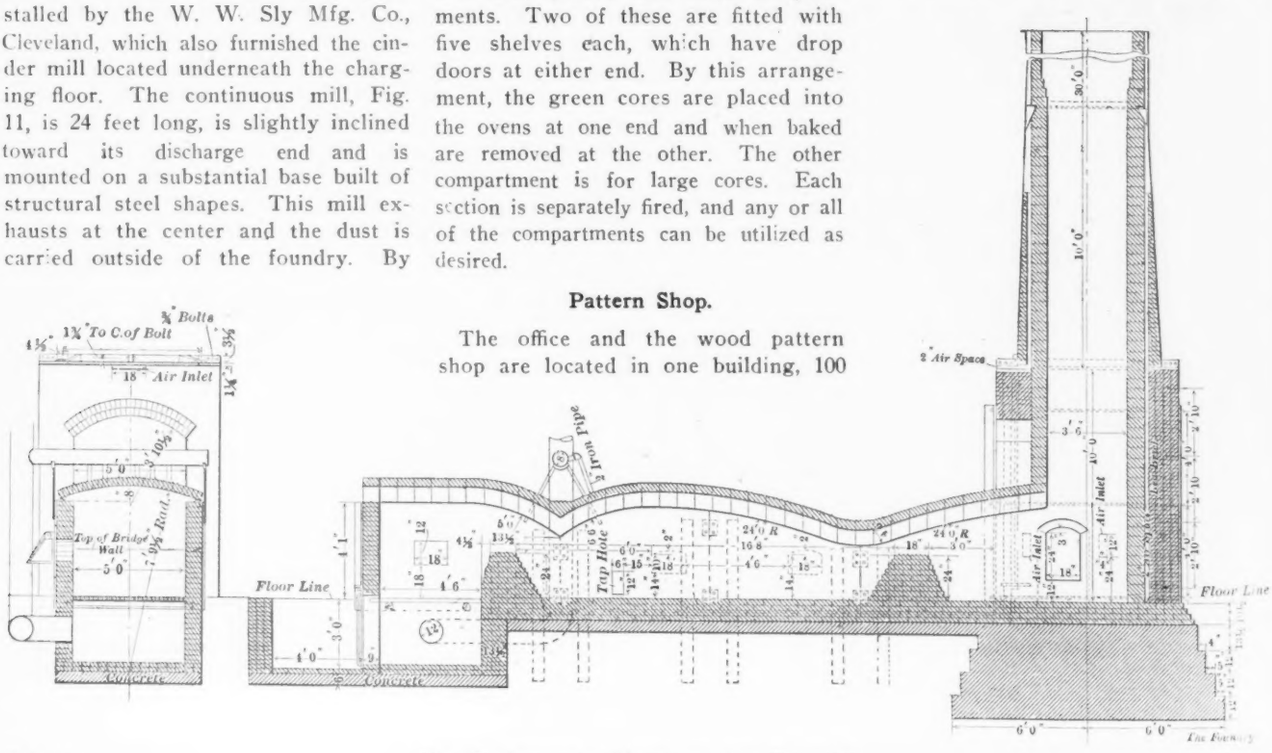


FIG. 7—SECTIONAL VIEWS OF AIR FURNACE

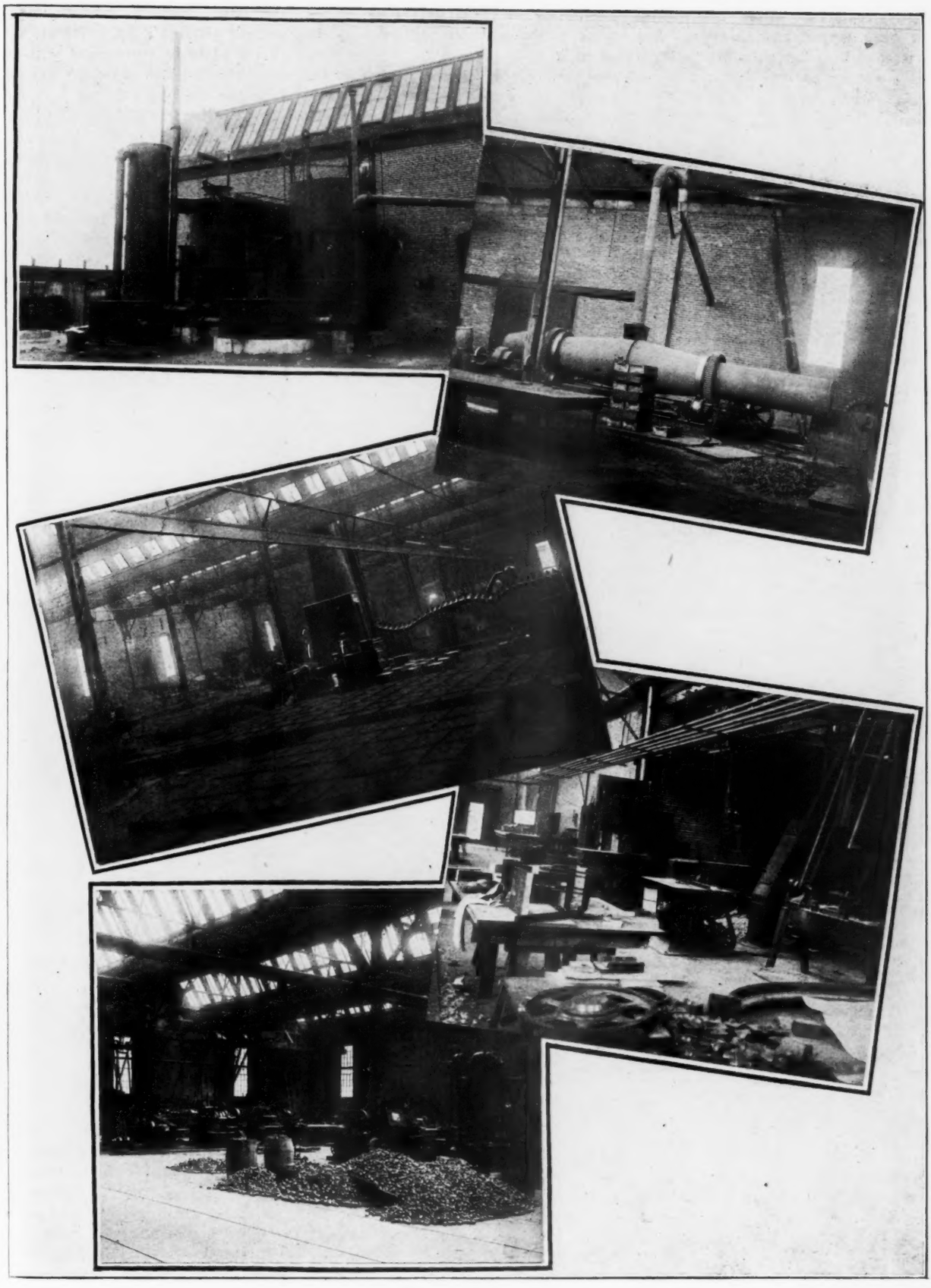


FIG. 8—PRODUCER PLANT
FIG. 9—VIEW OF FOUNDRY, SHOWING AIR FURNACE
FIG. 10—MACHINE SHOP
FIG. 11—CONTINUOUS TUMBLING MILL
FIG. 12—PATTERN SHOP

dinarily required. After the fittings have been tapped and threaded, they are washed in a barrel, which is lifted from a vat by an overhead trolley to a table where they are sorted and packed.

The power plant equipment consists of a 100-horsepower Buffalo tandem gas engine installed by the Allberger Co., Buffalo, which is belt connected to a 45-kilowatt Burke electric generator.

the plates which fit over pins on the table of the machine are similarly located and drilled. After this preliminary work, the plates are ready for the split patterns. These are all made of white metal, instead of brass. A plaster cast is made from half the master pattern when it is received from the wood pattern shop by the metal patternmakers. From this cast, an iron mold is subsequently secured in which the metal pattern is made. After the best possible method of gat- pattern plate as a jig, holes are drilled in the plate to correspond with those in the half patterns which are to be mounted on one side. A template, a trifle wider than half the plate is then made, having pin holes drilled at the top and bottom to correspond with those in the pattern plate. With the pattern plate as a jig, holes are drilled in the template to correspond with those made for locating half the pat-

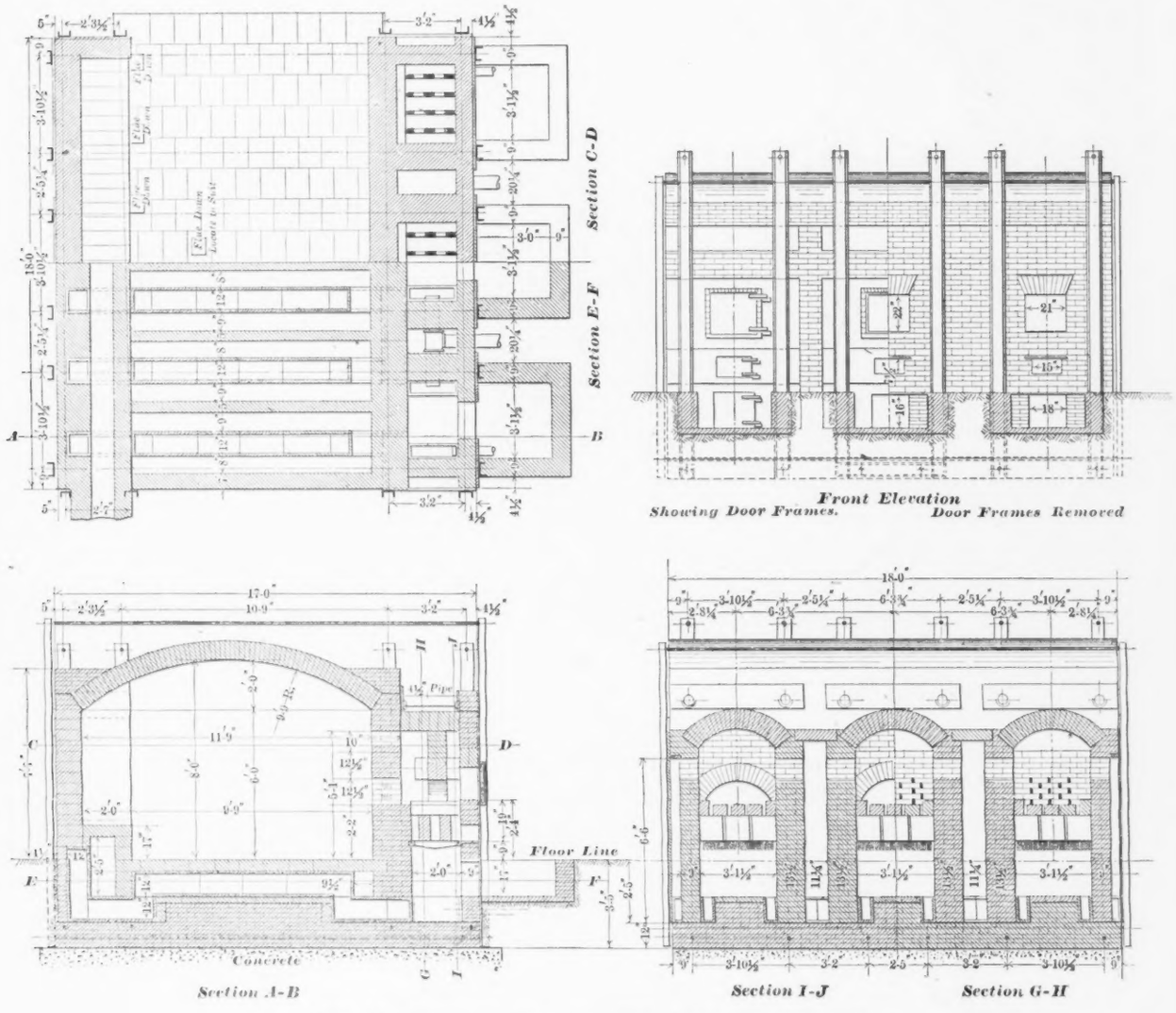


FIG. 13—SECTIONAL VIEWS OF THE ANNEALING FURNACE

Mounting Patterns.

The method of locating and mounting the split patterns on the pattern plates for the Berkshire machine as practiced at this plant is as simple as it is accurate. For ordinary patterns, 3-16-inch plates are used but for cored work, ¼-inch plates are required. For locating and drilling the holes through which the bolts pass for fastening the plates to the table of the machine, a jig is used, and the top and bottom pin-holes on ter the two halves of the pattern have been cast, they are accurately fitted together and soldered, and the holes are drilled for the brass rivets by which the half patterns are fastened to the pattern plate. The drilled halves should be accurately designated, that there can be no possibility of their becoming mixed with the other half patterns that are to be mounted on the same plate. Half of the patterns to be mounted are then placed in position on the plate to insure terns on one side of the pattern plate, and the template is then turned over on the other side of the pattern plate, and serves as a guide for the location of the rivet holes for the other half of the pattern. By this method, absolute accuracy is assured. The half patterns are then riveted to the plate and the gates adjusted.

More difficulty is however, experienced in making plates that are recessed on one side for green sand cores such as are used for making the

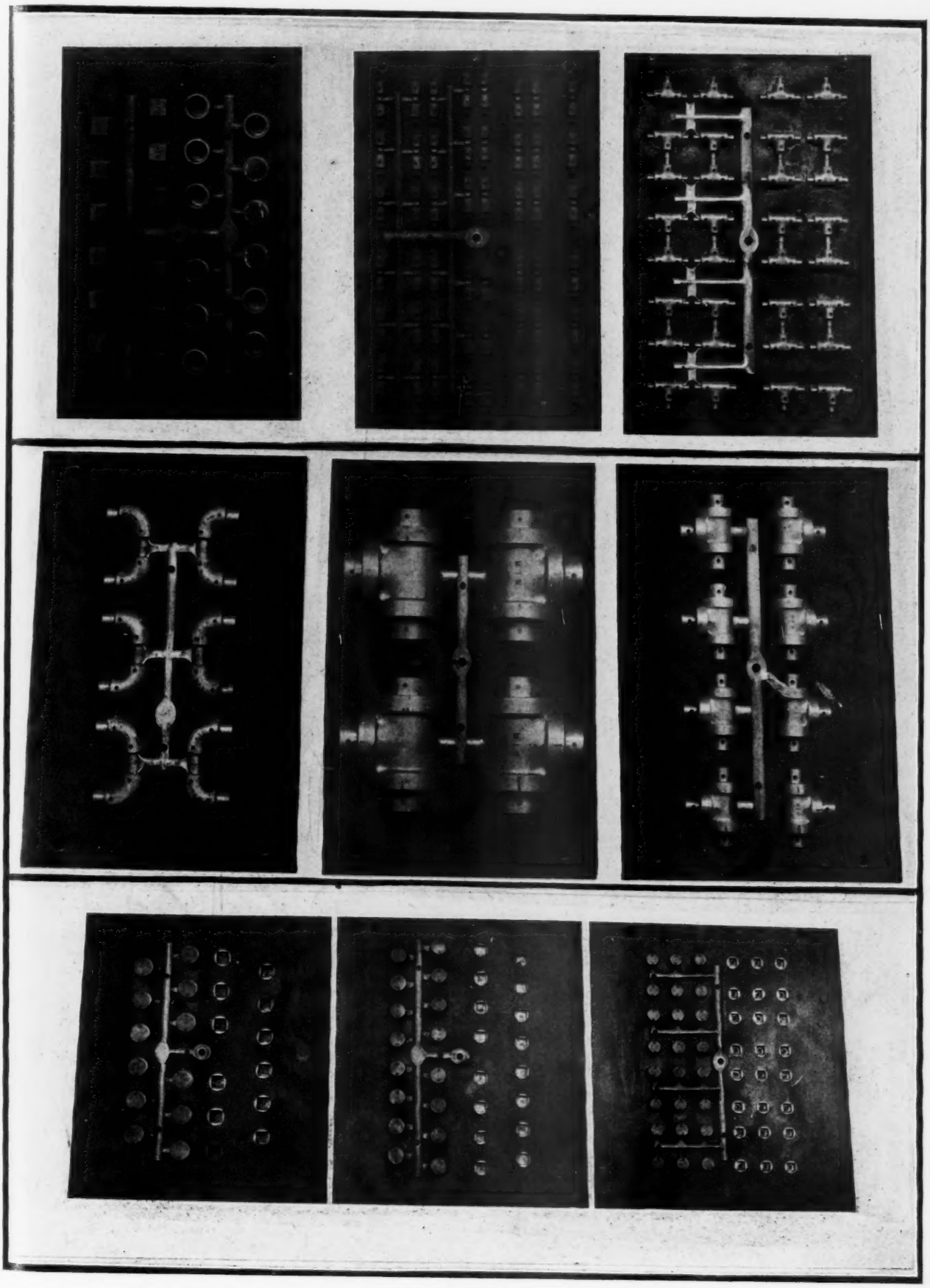


FIG. 14
FIG. 15
FIG. 16

FIG. 17
FIG. 18
FIG. 19

FIG. 20
FIG. 21
FIG. 22

molds of countersunk plugs shown in Figs. 16, 19 and 22. The metal patterns are drilled and located on the plate, which is then drilled for the rivets, and by the use of a template, corresponding holes are marked off on the other side of the plate. Holes somewhat larger than the core to be made are then drilled on this side of the plate which are later filled with white metal. A plug is then made having a head the exact size of the core, and the body of the plug is machined to fit snugly in the holes drilled in the template. The template and pattern plate are then fastened together, with the bottom of the pattern plate uppermost. The plug is then passed through the template, while the head remains in the hole drilled in the pattern plate. White metal is then cast around the head. The pattern plate and template are then turned over, the template removed and the plug withdrawn. This operation is repeated for every pattern on the plate. By the use of the template, the recesses for the cores are accurately located.

Pattern Plates.

Half patterns for 24 one-inch pipe plugs are shown mounted on the pattern plate in Fig. 14. Three of the halves of the plugs that are to be threaded are shown filled with plaster of Paris. When molding the solid plug, the cored section is filled with plaster, and in this way the plate serves for both standard and solid plugs.

Fig. 15 shows half patterns for six ½-inch elbows mounted on one plate.

The pattern plate shown in Fig. 16 is arranged for making 24 one-inch countersunk plugs in one mold. The green sand cores are made in the recesses in the plate.

Fig. 17 shows a split pattern mounted on one plate for making 96 ¼-inch solid plugs in one mold.

Fig. 18 shows a plate for making four 2-inch gray iron tees.

Fig. 19 shows the pattern plate for 32 ¾-inch countersunk plugs.

Fig. 20 shows the pattern plate for 32 ⅛-inch tees.

Fig. 21 shows the pattern for eight ½-inch gray iron tees.

Fig. 22 shows the pattern plate for 48 ½-inch countersunk plugs.

Gas Producer.

The company's temporary gas producer is now being replaced by a plant which will furnish gas not only for the engines but for fuel purposes throughout the works as well. It will be used in the annealing furnaces, for heating the core ovens, tempering and case hardening. The new producer plant shown in Fig 8 is designed for the use of anthracite and bituminous coal. It has a capacity of 250-horsepower and is equipped with a wet scrubber and dry purifier, with a gas exhauster direct-coupled to a motor which forces the gas into an automatic regulating gas receiver which will serve the annealing furnace. The gas for the engine is distributed direct through the main pipe, the regulating receiver acting as a balancer. As the gas from this producer is absolutely clean before it enters the pipe, it can be carried almost any distance for distribution without accumulating a deposit. No expensive brick flues will be installed in the annealing furnace in view of the fact that there will be no deposit of carbon or dust, and the furnace as built can therefore be readily arranged for the use of gas as fuel. This plant provides no facilities whatever for washing out the volatiles when using bituminous coal. All of the volatiles are intended to be converted into fixed gases in the generator itself, thereby increasing the efficiency of the bituminous coal producer plant approximately 15 per cent, and also eliminating an expensive tar extracting apparatus. Another feature of this plant is that only the gas itself is under pressure after it has been made, and the escape of gas from the producer, either while idle, or when in operation, is obviated. The regulating gas receiver has a capacity of only 450 cubic feet, and replaces the large gas holders generally installed having capacities varying from 2,000 to 5,000 cubic feet. The plant is being built by the Wile Power Gas Co., Rochester, N. Y., and while anthracite coal is generally used this plant has been designed for the use of bituminous coal.

Future extensions include additions to the foundry and machine shop, the erection of a galvanizing plant and pattern storage building. The Morse Iron Works is capitalized at $100,000, and the officers of the company are William Hamilton, president; Thomas G. Morse, vice president and general manager, and A. W. Brevellier, secretary and treasurer. H. F. Giehle, who has had a wide experience in malleable work is foundry superintendent.

PRODUCTION OF MOLDING SAND IN 1906

THE production of molding sand in the United States in 1906 amounted to 3,371,103 net tons, valued at $2,063,151, as compared with 3,084,098 tons, valued at $2,102,423 in 1905. These figures are taken from the annual report of the United States Geological Survey.

Molding sand, says the report, varies from clayey loam to a clean, sharp, coarse sand, according to requirements. Three essential qualities in molding sand are refractoriness, porosity, and bond. In general, the finer and more intricate the design the finer the sand required. Its refractory nature is governed by the presence of a high content of silica and the absence of such fluxing constituents as lime carbonate, alkalies, and iron oxides. The material, including the bond, must possess at the same time plasticity and strength. It must be plastic in order to be molded around the pattern, and it must have sufficient strength to stand when unsupported by the pattern and to resist the impact of the metal when poured into the mold. Too much clay and iron oxide will cause the mold to shrink and crack under the intense heat, yet too little will cause it to dry and crumble, if not to collapse entirely. Under a simple preliminary examination a good sand should show to the unaided eye grains nearly uniform in size, angular rather than round, and when spread on dark paper it should show no dust. To the touch the sand should feel sharp rather than smooth, and when moistened with 10 to 20 per cent of water it must be capable of being formed into balls which will not become pulpy or be too easily crushed.

The following analyses show the average chemical composition and relative fineness of grain of standard molding sands used for various purposes:

Sand for delicate molding.—Silica, 81.50 per cent; alumina, 9.88 per cent; iron oxide, 3.14 per cent; lime, 1.04 per cent; magnesia, 0.65 per cent; grain, fine.

Sand for medium class molding.—Silica, 84.86 per cent; alumina, 7.03 per cent; iron oxide, 2.18 per cent; lime, 0.62 per cent; magnesia, 0.98 per cent; grain, medium.

Sand for heavy castings.—Silica, 82.92 per cent; alumina, 8.21 per cent; iron oxide, 2.90 per cent; lime, 0.62 per cent; magnesia, 0; grain, coarse.

THE SOLIDIFICATION OF CAST IRON*

Changes Occurring During and After Cooling—Crystallization and Contraction

BY E. L. RHEAD

THE production of strong, sound castings is the aim of the iron founder. For commercial purposes they must be produced as cheaply as possible. Few industries present greater difficulties for the successful attainment of the required results. The conditions are of such a widely varying character, and the control of them so difficult even when properly understood, that success in all instances is not assured.

From results obtained by scientific research, it has been established that success or failure depends almost entirely on the metal used and the treatment to which it is subjected in the melting and handling, in the molds, and after its removal from the sand. The effect of the treatment is determined by the chemical composition of the metal. So much has been established. But the part played by each constituent, and how the presence of another constituent may modify the result have not yet been solved. Synthetic methods, or the addition of separate substances to the iron, are the only ones by which this can be effected, and with a large number of variables, it becomes possible to form an almost infinite series containing the ingredients in varying proportions, thus making the task a difficult one. These points are mentioned because so many foundrymen still disregard scientific applications and sneer at the idea of improvement from such a source.

Cooling of Metal.

The behavior of metal while cooling is the principal point to be borne in mind. How it cools, whether uniformly or not, depends on the mold in which it is poured. Shrinkage, internal strains which produce incipient weakness, and in fact all other variations in structure and appearance are the result of changes which occur naturally, or are modified by design or accident, while the metal is fused, or in a heated condition. Molten metals cooling have a tendency to assume a crystalline form as they solidify. This property is due to some inherent principle resident in the ultimate particles of which the substance is composed, and is, as such, a characteristic of the body as any other. The exact manner in which it is manifested will depend on circumstances, but under the same conditions it will be exhibited in the same way and to the same degree. Since a crystal is an aggregate of small particles of the same kind but arranged in a peculiar manner, it can be seen that any particle in the crystal can occupy any position in the structure of which it forms a part. The form developed will be dependent upon the peculiarities of the substance. In some, similar influences operate equally in each of three directions at right angles to each other, and cubic forms result. In others the action is greater in one direction than another and different developments occur.

Properties of Crystallized Bodies.

The properties of crystallized substances differ from those of the amorphous bodies of the same composition in density, hardness, expansibility, etc., and the same body differently crystallized has special properties in each of its forms. Furthermore, all parts of the same crystal do not possess the same properties, as some are harder than others. These differences are due to the manner in which the particles are arranged in relation to each other. To use a simple, though probably not absolutely correct illustration, the bonding in brick work determines its strength, rigidity and other characteristics, as well as the materials of which it is built. A crystal may be made of material which arranged in one way is soft, and in another, very hard. In a similar manner, it is easier to dislodge some bricks from a structure than others. One part of a crystal may be harder than another because of the greater cohesion existing between its particles.

It is evident that crystallized bodies have distinctive properties not possessed by the substance in its uncrystallized state; that different forms are possible, and that the characters of a crystal may vary in different ways. To possess crystalline properties does not necessarily involve the possession of the crystal form. If the substance has been subjected to conditions that would produce the crystal, but is so confined that the free movement of the particles is interfered with and the full development of the form prevented, the product will still possess the properties of the crystallized substance in the form it assumes. Perfect crystals are only produced naturally when completely surrounded by fluid. This often occurs only at one side, although sometimes the whole space is surrounded by walls which interfere. However that may be, the substance and the properties are the same. If a fused body is cooled with sufficient rapidity no rearrangement of particles can occur and no crystals will be formed.

Probably no statement relating to the manner of crystallization of iron is more common than that the crystals arrange themselves at right angles to the cooling surface, and all foundrymen are familiar with the appearance of cooled sections of crystalline metals. When the molten metal entering the cavity of the mold comes in contact with the sides it is cooled and a crust of solid metal forms. This at first is thin and increases in thickness as the heat is lost. The inner surface is not smooth, but is roughened by the tendency to crystallize. How far actual crystallization can proceed will depend on the rate of cooling, but in all cases some attempt at crystallization will occur. As soon as an irregular surface has been produced inside the cavity, the solid portions will more readily transmit the heat from the interior.

Cast Iron.

Thus far we have only considered the cooling of a simple body, or rather, have considered cast iron as such. The composite character of cast iron is well known to all foundrymen.

*Read before the British Foundrymen's Association.

The silicon is combined with iron and manganese and possibly with other elements; the carbon in molten pig iron is in combination with the iron and manganese as carbides of those metals, and also in its free state as graphite, and as temper graphite in the solid; the sulphur as sulphides of manganese and iron, and the phosphorus as phosphide of iron. Whatever condition these elements assume when the iron is solid, in their molten condition they are combined with others and all the compounds are dissolved in the iron, which forms the bulk of the metal. If they were not dissolved, they would separate in layers owing to their varying specific gravities. We should, therefore, learn what happens when such a mixture of fused bodies sodidify.

The amount of a substance that can be dissolved and held in solution by a liquid is generally affected by the temperature. This obtains in ordinary cases of solutions in water. For example, at 0 degrees Cent., water will dissolve only a little over one-eighth of its weight of potassium nitrate. At 100 degrees Cent., it dissolves nearly two and one-half times its own weight, or 20 times as much. The solubility of matter is affected by the presence of others, and it is possible to cause the precipitation of a substance by the introduction of another soluble body. Thus, the introduction of salt in a soap solution, causes the separation of the soap. In view of these facts and the complex character of cast iron, the difficulty of tracing the possible changes in iron are apparent, as both relative amounts and the solubility of the substances present in the iron will affect the result.

Changes in the Solid State.

Recent investigations show the possibility of changes taking place in the solid that were formerly only thought possible in the liquid state. Iron, which forms the principal constituent of the molten metal, contracts on solidification, and when crystallized is denser at its solidifying point than when molten. Carbide of iron remaining in solution does not prevent contraction, and cast irons containing the most combined carbon contract more than others, for example, white iron castings. If, however, the carbon precipitates during the progress of the solidification, the separated graphite will be less dense and will occupy greater space, so that the metal cools and contracts, this internal increase in volume compensates for the contraction and may actually exceed the contraction of the iron that occurs at the moment of solidification. This accounts for the expansion and the fact that metal is lighter in the solid than in the fluid state. This separation progresses throughout the cooling mass, and may be completed when the heat is prolonged. It continues after solidification has commenced, as Keep has shown, the amount of combined carbon becoming less during the cooling. That this separation is progressive and may be aided or retarded is evident from the changes that occur in the manufacture of annealed or malleable castings and in the softening of ordinary gray iron castings that are to be machined. The prolonged heating of such castings produces a separation of the carbon and temper graphite. Castings that undergo this treatment expand permanently and increase in size from 1/32 to 1/8 of an inch per foot. This heating has permitted the completion of a change that would have occurred in the ordinary cooling, if the latter had been prolonged.

Contraction.

All foundrymen are aware of the fact that ordinary castings—that is, the heavier ones—contract less than those light in weight. This is partly due to the slower cooling of the greater mass. Closely associated with crystallization and the principles regulating it, is the formation of cavities in castings. As the metal solidifies, it attaches itself to the faces of the existing crystals, and is consequently drawn toward the cooling parts. These crystals extend inwardly and project into the molten mass. As long as channels exist between the crystals by which the metal can move down to supply the deficiency, metal will be drawn from the fluid interior. As long as it remains in contact with the crystals, it will continue to deposit fresh layers on their sides. This withdrawal of metal accounts for shrinking holes, and traces of crystals can generally be found on the faces of such cavities. Generally, such holes are rough on the interior and are gray in color. Sometimes they are colored by oxidation of the surface. The holes formed in this way are vacuous, and gases from the metal or steam drawn through porous places may enter the cavity if it is a large one, while the metal is still hot enough to decompose it, and colored films are produced.

Sometimes these holes are accounted for by the liberation of the gases from the metal of the casting. Such explanations are only half true, however. They may be filled with such gases, but the holes into which the gases pass were originally formed during the process of solidification. Any condition that has a tendency to keep the metal hot locally will cause cavities of this nature, and the advantage derived by splitting up gates to carry the metal at different points is due to the more equal distribution of the heat.

By the use of only one gate, all the hot metal has to pass a certain part of the mold, which makes that portion much hotter than the rest and cools more slowly. By the use of several gates, the heating of the mold at one point is prevented and the cooling is more uniform. The cracking of plates and other castings while cooling, is due to the weakness resulting from the withdrawal of the metal from the parts that crack generally, such as the center and the intersecting lines in the angles of the casting, due to the solidification of the metal between the crystals.

Another phenomenon connected with solidification should be noted. It is possible to cool a solution to a point below that at which it should crystallize or solidify without a separation of the solid matter with ordinary salts dissolved in a solvent. This is known as super saturation of the liquid, and with fused mixtures suffusion. In ordinary cases it is necessary to keep the cooling liquid absolutely still. Agitation, or the introduction of a crystal will cause it to solidify at once. All the conditions suitable for such absolute stillness are found in a cooling casting of a large size. The result of the cooling has a tendency to envelope and retard the movement of the fluid so that when it finally solidifies, any change in volume, whether an increase or decrease, and any heat evolution resulting from the latent heat evolved, occurs suddenly.

MAGNALIUM ALLOYS.

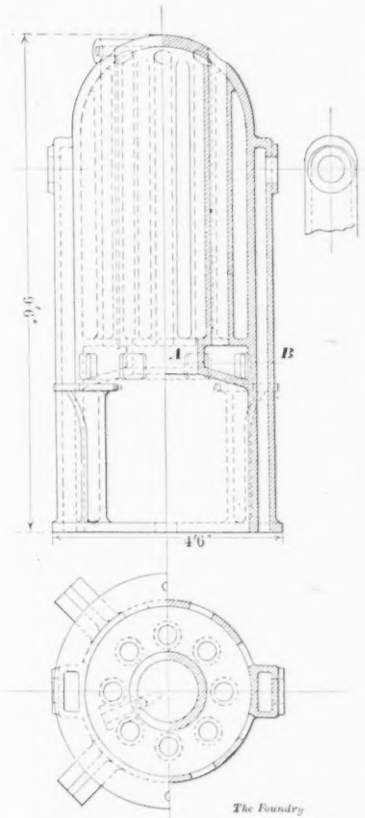
Magnalium alloys are made from mixtures of aluminum, copper, zinc and magnesium, and they are remarkable for two causes. The first is that they are lighter than aluminum, at least if the magnesium is present in quantity; and the second, that their strength is superior also. Magnesium is the only metal that is lighter than aluminum. Castings of magnalium can be made in chills, or in sand and water-chilled having a tensile strength of from eight to 27 tons per square inch, according to the amount of magnesia present. The best results are obtained by using from 10 to 15 per cent of magnesium; this gives an alloy which melts at about 700 degrees Cent. This alloy is sold by C. W. Leavitt & Co., 220 Broadway, New York.

MOLDING A RETORT CASTING

Difficulties Experienced With a Poorly Designed Pattern and How They Were Overcome

BY JABEZ NALL

THE pattern-making and molding of the retort casting shown in Figs. 1 and 2 demands careful attention not only on the part of the patternmaker, but the molder as well. The variation of the metal distribution adds to the other difficulties, as the heaviest portion of the casting, the crown of the dome, is 2½ inches thick, while the lightest portion, that of the tubes connecting the dome with the center chamber, is ⅜ inch in thickness. The tendency for this section to pull apart while cooling can be successfully overcome by enlarging the fillets at the ends of the tubes and carefully stripping the casting at the top as soon as the metal is fully set, to allow the heaviest portion of the casting to shrink first. The temperature of the cores at the time of pouring forming these tubes also has a bearing on the shrinkage. The tubes being so far removed from the outside shell receive little benefit from the heat or motion of the metal while pouring until it begins to rise in the tubes, and the cores should not be cold enough to chill the metal as it rises, and thus prevent its uniting with the metal flowing from the crown.

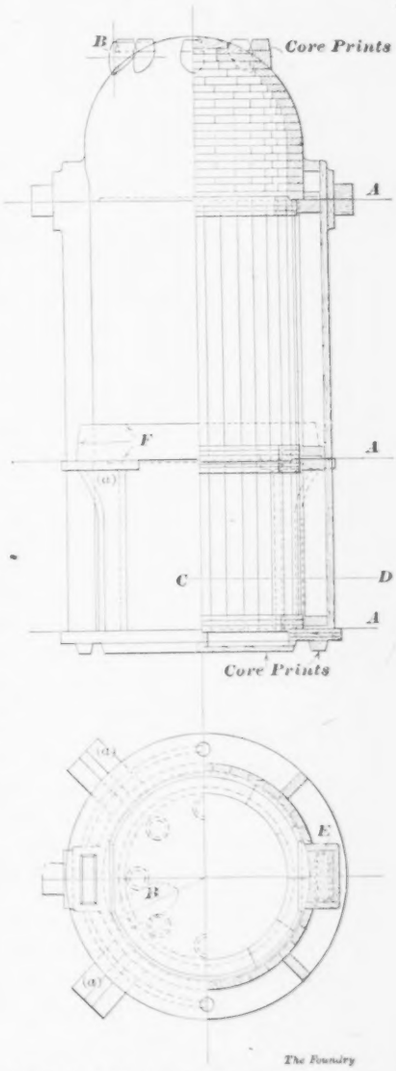


FIGS. 1 AND 2—FRONT ELEVATION, SECTION ON CENTER LINE, PLAN AND SECTION A B OF RETORT CASTING

Methods of Molding.

The cheapest and best method of making this casting would have been in a loam mold, in view of the fact that only one had to be made, but when a large number are to be produced, other methods would be more economical. The loam mold would not only reduce the necessity of pattern work, foundry rigging, etc., but would result in a safe mold and a better casting. The pattern for this casting was not made under the supervision of the writer, but was produced in a job shop. The loam method would not only have saved 70 hours of labor in the pattern shop, but about 600 feet of lumber as well. The foundation, covering plates and the rings required for the loam method would furthermore have been much cheaper than the four sections of a new iron flask with the necessary bars and chucks required for a skin dried mold. The time required for molding by either method would be about the same.

In each case the mold would be placed in a pit for casting and rammed up around the outside to the level of the foundry floor. With the loam mold, this would be continued to the top of the curbing. In both cases, the upper section of the center core would be formed of core sand. Another point that should be given consideration is the construction of this core and its removal from the casting. In designing this portion of the pattern, the job shop was at fault, as will be shown later. Whatever is used to strengthen this core, must be removed through the 15-inch opening in the center, and it is evident that any rods bent around the tubes would be difficult to take out and would add materially to the time required for cleaning the casting. This core should be made on end and stiffened by a series of light cast iron gratings having prickers cast on and reinforced



FIGS. 3 AND 4—FRONT ELEVATION, LONGITUDINAL SECTION, BOTTOM VIEW AND SECTION C D OF PATTERN

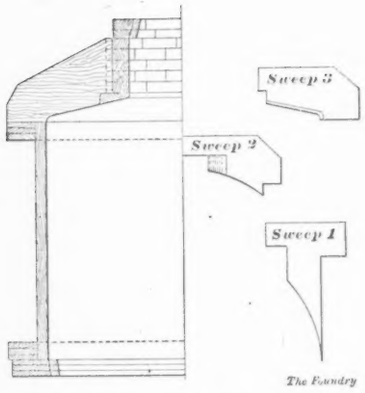


FIG. 5—SWEEPS AND CORE BOX ARRANGED FOR LOWER SECTION OF CENTER CORE

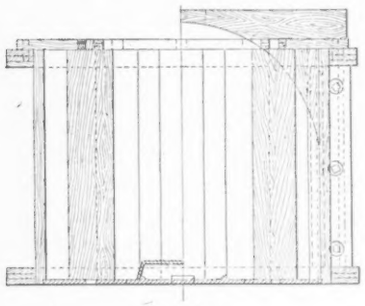


FIG. 6—MIDDLE AND UPPER SECTION OF CENTER CORE BOX

by a few straight rods extending the length of the core. The cast iron gratings could be easily broken when taking out of the core, and for convenience in handling it should be made half length, which would likewise prevent its sagging from extra weight.

Pattern and Casting.

Fig. 1 shows a half longitudinal section of the casting, and to the left of the center line is a half view of the front elevation. Fig. 2 shows a half section on the line AB of Fig. 1, and at the left is shown a half of the plan or bottom view. The same plan is followed in the drawing of the body of the pattern shown in Figs. 3 and 4, the construction of which is indicated, the pattern being made in sections as shown by the parting lines A. The bottom flange of the pattern was built up of segments, with the circular core print built on and turned. A portion of this print was later cut off to act as a tell-tale for the setting of the center core, and the core prints for the oblong passage, cores E 1, were attached.

Making the Flange.

When building a thin wide flange such as shown, we have found it good practice is to construct it as illustrated. The center row of segments are made not more than 1½ inches wide at each edge, and pieces are laid in between the opposite way of the grain. These should be of uniform thickness and should be laid in loose, except for a few screws inserted to tie them together. No glue should be used on these inside fillers, which permits shrinkage or expansion of the outside material to take place at will. With fair treatment in the pattern storage, flanges thus constructed have been found to keep true for years. The body of the pattern was built of lags or staves attached to rings previously built up of segments and turned, having male and female joints for adjusting each section in position, blocks being added, to which the side projections, E, are built. The making of these lags may seem quite a job of hand work, but a good jointer and an adjustable rip saw, correctly and carefully operated, leaves little work to be done on the bench.

Pattern Changes.

The top section was built up on face plate and turned, bosses and co prints being added later. This co pleted the pattern as it came from th job shop where it was made, but w added a core print for the chamb core, shown at F, Fig. 3. Witho this print, there was nothing to secu this core except chaplets, and the were objectionable in this castin Furthermore, the job shop constru tion involved considerable risk casting, owing to the difficulty of co trolling the vent from this core, an the possibility of the metal entering the vent through straining of the mold. By adding this print, the core was secured without other aid, and by carrying the vent away from the metal all risk was eliminated. In all cases where possible, and particularly if the cores are large, it is best that they be made so that they rest upon the plate when drying in the same position in which they enter the mold.

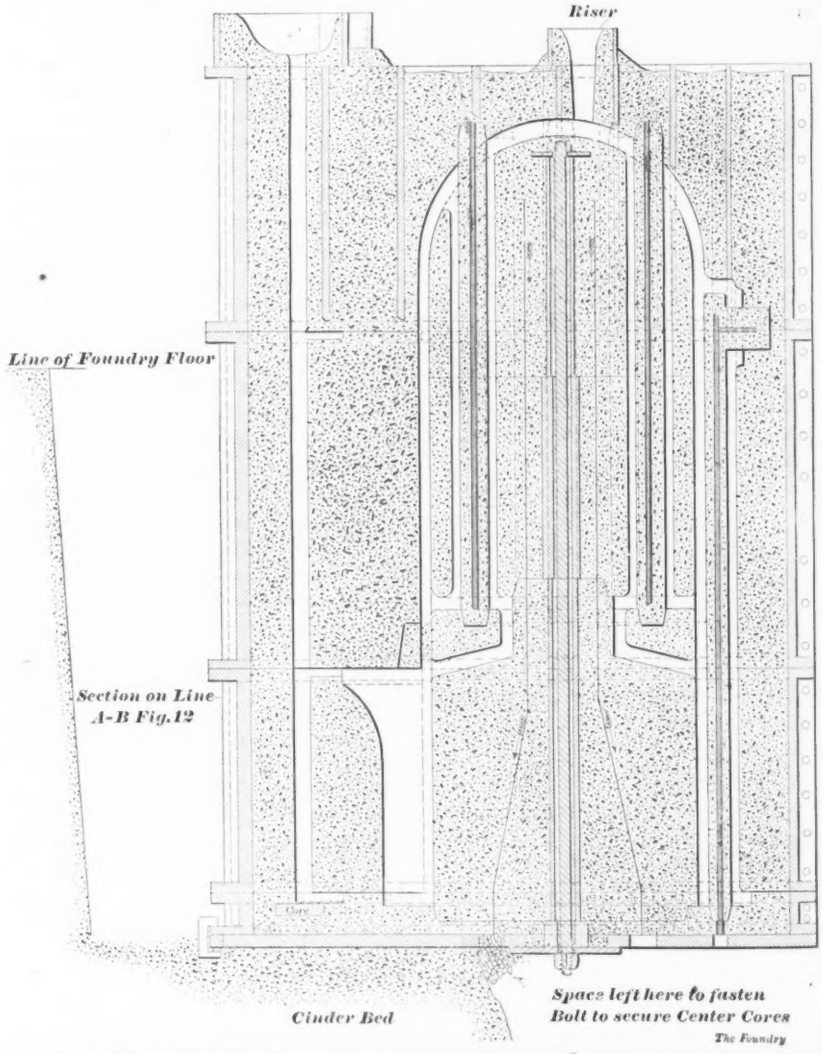

Riser
Line of Foundry Floor
Section on Line A-B Fig. 12
Cinder Bed
Space left here to fasten Bolt to secure Center Cores
The Foundry

FIG. 11.—SECTIONAL VIEWS OF COMPLETED MOLD

Center Core.

The patternmaker who made the pattern for this casting was at fault, having constructed all the center core boxes in half circles split longitudinally. This was by no means good practice, even for the plain round core for the lower section, as it necessitated the jointing and bolting of this core, while for the upper section it was entirely impracticable. Section CD, Fig. 1, shows how difficult it is to ram up and bind this core with the pipes in position, on account of the small amount of sand between the pipes and the necessity for good clear vents. It was extremely difficult to construct this core so that the two halves could be secured together, and it proved impossible, even with care, to set it on end in the proper position for placing it in the mold. In doing this the core broke, and it finally became necessary to reconstruct this core box, as shown in Figs. 6 and 7.

The head was made in reverse order to that shown in Fig. 3, and one-half of this was discarded. Four 6-inch holes were accurately cut through the half that was used in order to pull out the pieces forming the pipe section. The box being full length, the same amount of material was used in the body as would be required to construct a full box half length, and as shown, this was used also for the lower section. The point we desire to convey does no so much entail the saving of lumber, but the amount of time wasted and the bad practice pursued.

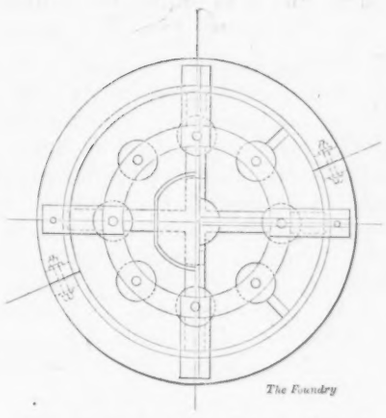


FIG. 7—CORE BOX RINGS BOLTED TOGETHER

The main body of the core box, as shown in Figs. 5, 6 and 7, is arranged lengthwise to suit the three sections of the main core without change, and are built on two rings cut in half and arranged for bolting together, as shown in Fig. 7. In arranging the lower section, a ring was built up to form the print. This was cut in half and blocked off to fit tell-tale and screwed to the body of the box. Another ring was built up and turned for the 15-inch opening at top, having a projection turned true on the outside on which to slide sweep No. 3, and centered on the top of the box by four wings cut to the required shape on the lower edge. This core was made on the drying plate, and when completed the box was arranged for the middle section shown at the left of Fig. 6. A ring was built up, holes were bored on the correct centers accurately spaced to the center of the pipe sections, and four pieces were built on to rest on the body of the core box and thus accurately hold the ring in position on the box. This was light and easily removed to permit the placing of the cast iron core gratings heretofore mentioned.

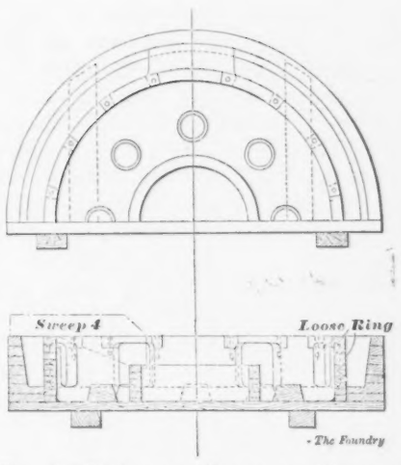
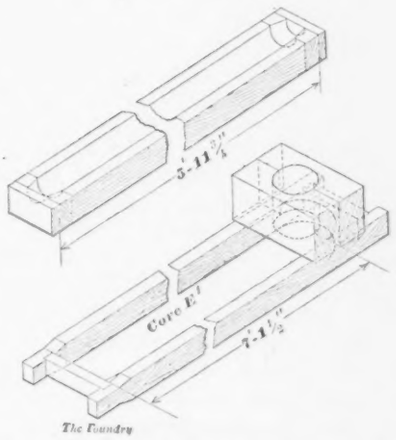


FIG. 8—PLAN AND SECTIONAL VIEW OF CENTER CHAMBER CORE



FIGS. 9 AND 10—CORE BOXES FOR CIRCULAR AND OBLONG PIPES

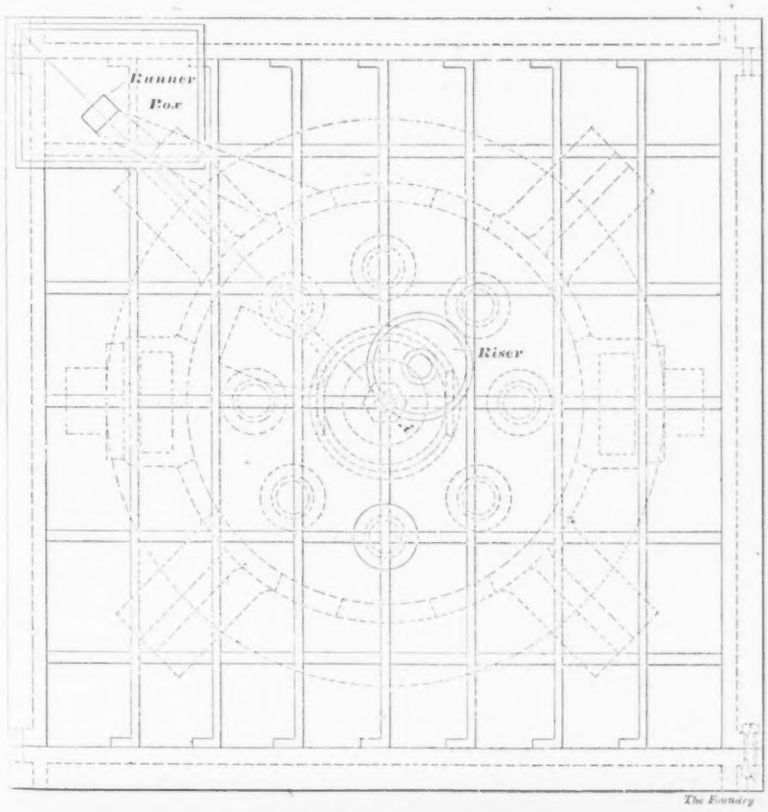


FIG. 12—PLAN VIEW OF MOLD

Centering the Pipe Sections.

To permit the centering of the pipe sections at the bottom, a similar but lighter pattern was made having cored holes to fit the pins on the pipes and having spots cast on to set the core print for which a light pattern was

also provided. One casting was made for the core print and two for the centering ring. The arrangement for this section of the core is clearly shown. The cast iron ring and core print were left in place until the core was dried. The box arranged for the top sections is shown at the right of Fig. 6 and 7. A cross, made with center blocked to carry sweep No. 2 was attached to the top piece used on the middle sections and sweep No. 1 was made to ride on this and the outside body. Eight pieces similar in shape were cut and placed between the pipes and the outside body, which gave the correct shape of the dome at this point where the sweep could not travel. This left a little finishing to be done when the box was removed, but otherwise, it is the most practicable way of making these cores, as it is easy for the coremaker to ram up and place any binders and supports for securing and bolting the cores in the mold, as shown in Fig. 11.

A plan and sectional view of the core for the center chamber with the face board removed is shown in Fig. 8. The ring that forms the outside shell of the metal could be easily made tight on the box, but it will materially help the coremaker to have this loose, as it supports the core while the box is being lifted off. The four bridges over the opening doweled in position are removed before rolling over. Core boxes for the circular and oblong pipes are shown in Figs. 9 and 10. Fig. 11 shows the completed mold in section, at the right of the center line and at the left on the line AK. The gates and runners are shown in Fig. 12. For convenience, and to prevent confusion of lines, flask bolting, vent holes, etc., are omitted. The general direction of the vents are indicated by the arrows.

The Mold.

As the completed mold was about 11 feet high, it was necessary for convenience that a part of it be made in the pit. However, as the mold must be lifted away from the pattern section by section for finishing and drying as well as to permit the withdrawal of the pattern, this pit can be located at any convenient point in the foundry and later when the mold is assembled, it should be placed in the regular casting pit, having a cinder pit for vents. The method of molding was similar to the regular practice for making skin dried molds, and the only features requiring comment consist of the securing of the cores and the method of gating shown in Figs. 11 and 12. The cores were secured by a 1½-inch bolt provided with suitable plate washers, the cores having previously been provided with tube or iron supports in the center, so that in the three sections they came iron to iron, which prevented the crushing of the sand when the bolt was tightened. In order to secure access to this bolt when the mold was assembled, a trench was left in the bottom of the casting pit of sufficient size to permit one of the molders to easily reach the bolt. After the bolt was secured and the core filled in at the top and this part dried, the trench at the bottom was used as a duct for the gases from the cores, which were carried away as indicated in Fig. 11 and piped to the top of the foundry floor.

Gates.

The method of gating shows the first gate connected to the bottom flange at a tangent to give a whirl to the metal. The second gate was connected with the plate of one of the brackets, and the third was constructed similar to the first at the joint of the top section of the mold.

GATES AND RISERS OR SINK-HEADS

BY P. R. RAMP

A CAREFUL study of the utility of risers, gates and sink-heads is of the utmost importance to every foundryman, as by their judicious use foundry losses can be materially reduced. It is not my intention to advance new ideas, but to explain in detail and as briefly as possible the various methods in vogue.

There are several kinds of risers and sink-heads, including top risers, side risers, pop-gates, strain-gates and sink-heads. Fig. 1 shows the sectional view of a small crank disc mold. In this case a top riser is used which is shown at A. Note the opening into the

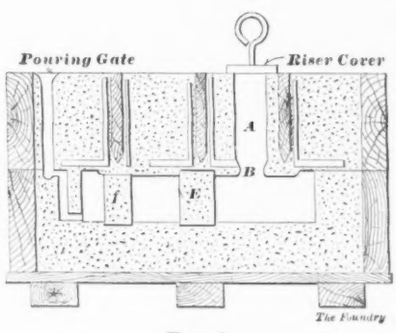


FIG. 1

mold at B which is reamed out nearly as large as the riser proper in order to prevent the iron from becoming solid at this point before enough iron has been fed into the mold through the riser to prevent a shrinkhole. It is necessary to churn a riser of this kind in order to keep a channel open to the heavy portion of the casting as long as possible, which makes it possible for the mold to be fed with hot iron.

The result of not keeping a riser open long enough, or of not making the opening B, Fig. 1, large enough, is illustrated in Figs. 2, 3, 4 and 5. These show a steam hammer die molded with a top riser. Fig. 2 is a

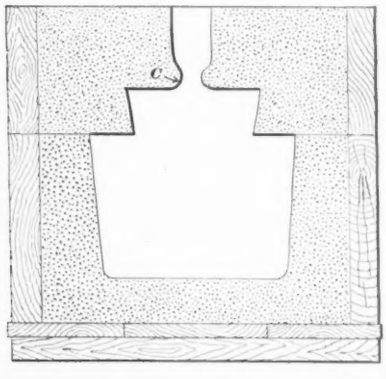


FIG. 2

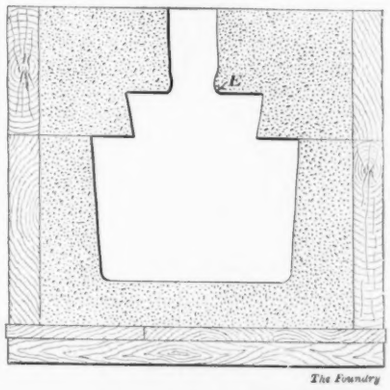


FIG. 3

sectional view of this mold, showing a small opening at C and Fig. 4 gives the result in the casting at B. This defect is either the direct cause of allowing the riser to freeze up too soon or the small opening at C, Fig. 2, became congealed and shut off the supply of feed metal from above. Fig 3 is a sectional view of the same kind of a mold, showing the proper way to connect the top riser with the mold. While this will cause more work in the chipping shop, the difference in the number of defective castings will pay for it. Fig. 5 shows a reduction in the size of the spongy spot in the casting, also difference in its location which results in less harm to the casting.

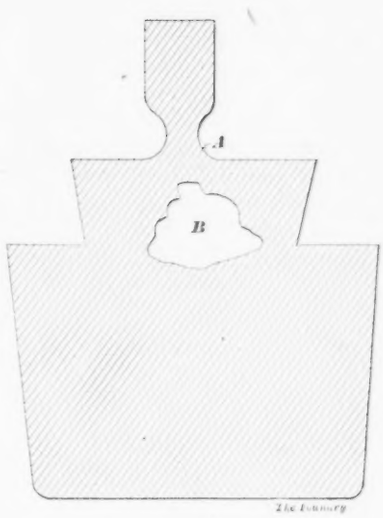


FIG. 4

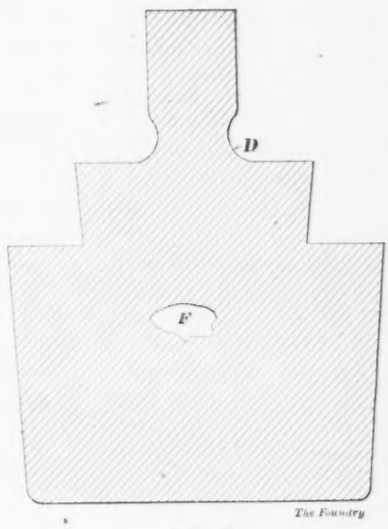


FIG. 5

Cylinder Mold.

Fig. 6 shows a sectional view of a cylinder mold cast in a horizontal position. The risers are usually placed as shown on the highest point of both flanges. These risers are seldom churned as the section of metal is not generally of very great thickness and the risers are of more benefit for the pressure they add to the mold than as feeders.

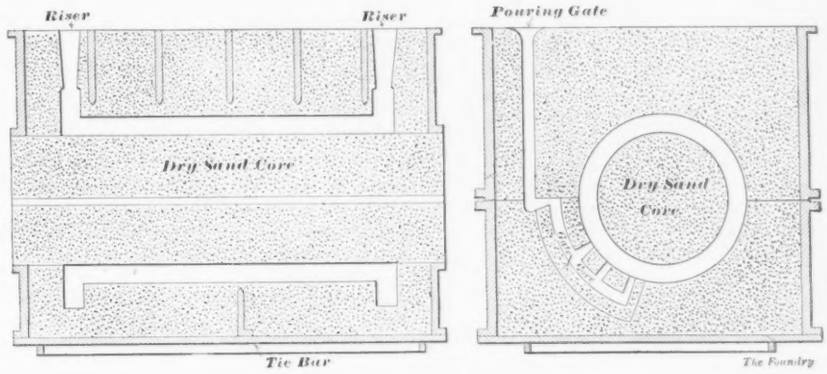


FIG. 6

Fig. 7 is a sectional view of a cast drum mold used for steam heating purposes giving a good illustration of the pressure riser. In making molds of this kind that require a large core that is completely surrounded except a small opening for the vent, it is very essential that risers be used and raised as shown here as it requires considerable pressure of iron to force the gas created in the core out through the proper channel and to prevent it from working up through the liquid metal. The number of risers in a core of this kind does not regulate the pressure of iron but the height over the top of the mold. In making molds of this kind it is very important to raise the gate and risers, the number required depending on the area of the mold.

Side Risers.

Fig. 8 shows a mold with a side riser. This is a very simple and effective method of feeding castings of this kind. In using this riser it is good practice to make the parting line a little below the joint at the point where the riser is to be connected with the mold as shown in Fig. 8, as this will prevent the riser from breaking a piece out of the casting when it is knocked off.

Fig. 9 shows another example of the side riser which is a sectional view of a railroad center plate casting. The joint is made low where the riser is broken off, shown at A.

All top and side risers should be covered if the piece being cast is of very large dimensions and made in green sand, as with the riser open while pouring, a current of air is formed toward the open riser which does much damage in blowing off delicate points of the mold. This does not happen with the riser covered, and a closed riser keeps the air pressure on the surface of the mold and prevents scabbing by holding the portion of the mold that is subject to intense heat before the iron reaches it in its place. On very heavy cast-

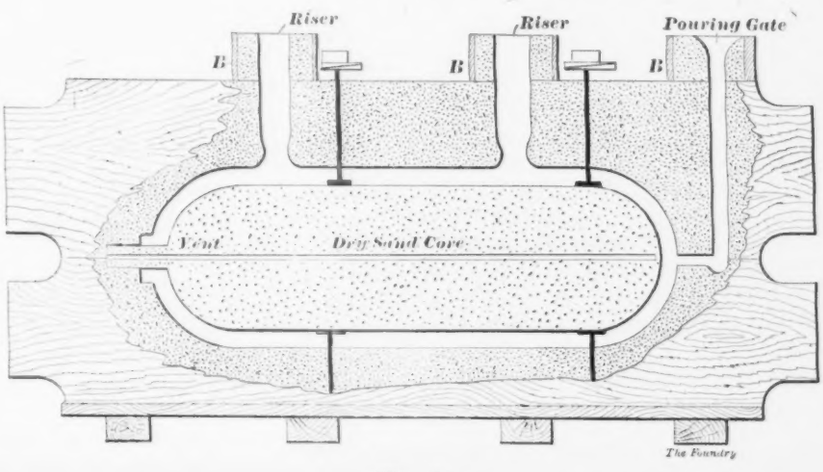


FIG. 7

ings, requiring some time to fill the mold, unless this air pressure is confined in the mold, the cope surface of the mold will curl up in patches and drop into the mold before the iron reaches it. A suitable riser cover is shown in Fig. 1.

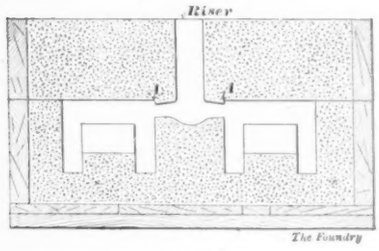


FIG. 8

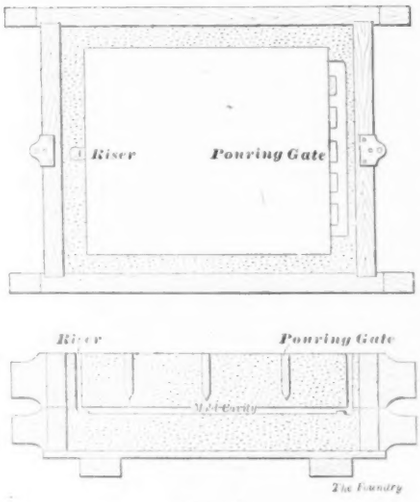


FIG. 10

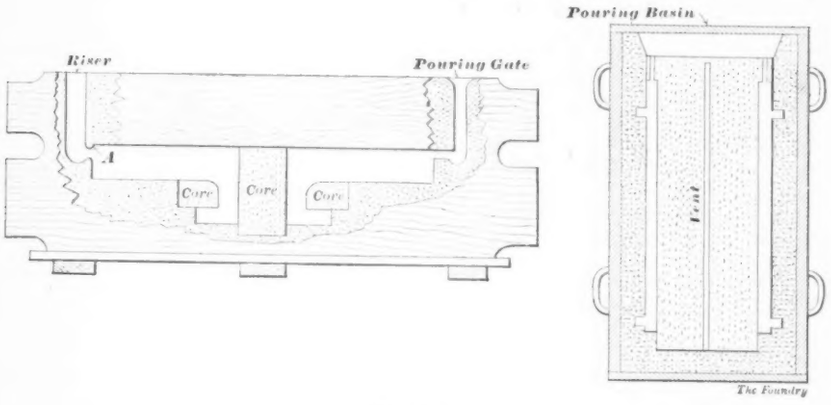


FIG. 9

Strain Gate.

Fig. 10 shows another style of riser which is termed a strain gate and is used to release the lifting pressure on the cope the instant the mold is filled. A riser of this kind is necessary for small thin work as it prevents run-outs and fins. The above are but a few examples of everyday practice.

INFLUENCE of CARBON on CAST IRON

W. H. HATFIELD, Carnegie scholar, has made a report to the Iron and Steel Institute on the influence of carbon on cast iron. His recent investigations were made for the purpose of determining if possible the regions of temperature in which the carbides are decomposed, and to ascertain whether the recalescence point had that important bearing upon the decomposition inferred from previous work carried on by noted metallurgists. The material used had the following analysis:

	Per cent
Combined carbon	3.40
Graphite	Nil.
Manganese	0.14
Silicon	1.10
Sulphur	0.06
Phosphorus	0.04

The whole of the test bars used were cast in the same molding box from the same ladle, and were allowed to cool in the sand. They were all heat treated together in the same annealing oven; the "transformation" of the structure being arrested at different temperatures, as required, by rapidly cooling in the air. Six bars were taken:

No. 1 was the initial material as cast.

No. 2 was the material after it had attained a heat of 780 degrees Cent. (1,436 degrees Fahr.)

No. 3 was the same when 820 degrees Cent. (1,508 degrees Fahr.) had been attained.

No. 4 was the material when 860 degrees Cent. (1,580 degrees Fahr.) had been reached.

No. 5 was the material that, without exceeding 900 degrees Cent. had cooled during a period of 24 hours to 750 degrees Cent. (1,382 degrees Fahr.)

No. 6 was the material that, after a further 24 hours had cooled to 650 degrees Cent. (1,202 degrees Fahr.)

It will, therefore, be seen that No. 1 represents the iron as cast; Nos. 2, 3 and 4 are on the upward curve, and Nos. 5 and 6 represent the period of cooling down. A test bar was rapidly cooled in air, as described, from each of these temperatures, and a section made, polished and etched with picric acid.

The structure of No. 1, the original cast iron, consisted of pearlite and cementite, the latter existing as well defined membranes.

With No. 2 the cementite had become broken up, and the pearlite contained numerous small nodules of cementite. No temper graphite or annealing carbon was present. This certainly looked as if the pearlite had absorbed some of the cementite, which had again been thrown out during the rapid cooling.

No. 3 showed a groundwork of pearlite, in which were noticed the broken up and fastly disappearing membranes of cementite. Temper graphite was also present in nodular form.

No. 4, which was the sample that attained 860 degrees Cent., was similar to the last described structure, but contained much less cementite and more graphite. This showed that the transformation of the material was progressively taking place.

No. 5, which represented the metal when the cooling had commenced, consisted of a matrix of pearlite in which were numerous areas of ferrite, besides the ever increasing temper graphite. Here and there, also, were to be seen small particles of the undecomposed cementite.

No. 6 consisted practically of ferrite and graphite. The bulk of the pearlite had therefore disappeared during cooling from 750 degrees Cent. to 650 degrees Cent.

These experiments suggest that the decomposition of the carbide, Fe_3C, the cementite, took place between 800 and 900 degrees Cent. (1,472-1,652 degrees Fahr.), and that the pearlite or subcarbide decomposed between 740 and 650 degrees Cent. (1,364-1,202 degrees Fahr.)

The general character of the temper graphite, or "annealing carbon," seemed to be that of a nodule with rough and diffused edges. On exam-

ination at high power the nodule revealed a laminated structure, as if it consisted of numerous laminae and membranes of free carbon in some ferritic constituent. Certainly this type would lead one to believe that these nodules do not consist of entirely free carbon.

Another variety has as its chief characteristic the practically structureless "kernel" of the interior of the nodule, which is surrounded or inclosed by a band of black constituents, presumably free carbon. The kernel is generally of a brownish slate color. It would almost appear that the latter is a further development of the former.

A new series of experiments was made to thoroughly test the influence of the casting temperature. The first series was with hard and white irons, the second with soft and gray ones. In each case the "hot" is very hot, the "fair" an ordinary working temperature, and the "cold" just fluid enough to satisfactorily run the test bars. The bars cooled in the sand. The results obtained with the white iron are given in Table I, the hot, fair and cold being all poured from the same ladle in sequence.

Table I.

WHITE IRON.

Analyses.

No.	CC	Gr	Si	Mn	S	P	Temperature.	Condition as	Ult. stress. Pounds.	Elongation. Per cent.	Reduction of area. Per cent.
A	3.43	...	0.93	0.10	0.056	0.03	Hot.	Cast	24,953	...	...
B	3.40	...	0.93	0.10	0.056	0.03	Fair.	Cast.	17,808	...	...
C	3.41	...	0.93	0.10	0.056	0.03	Cold.	Cast.	38,528	...	...
A	0.56	2.61	0.93	0.10	0.057	0.03	Hot.	Heat treated.	54,656	1.0	1.5
B	0.55	2.58	0.93	0.10	0.056	0.03	Fair.	Heat treated.	77,056	1.16	1.47
C	0.56	2.59	0.93	0.10	0.057	0.03	Cold.	Heat treated.	77,728	2.0	2.7

On referring to the table it will be seen that the tensile tests in the cast state show the "fair" giving the lowest test, abnormally low for a white iron; the "hot" giving a moderate result, but the "cold" a decidedly good one. The microstructure of the "cold" bar showed a well mixed, well knit structure of cementite and pearlite, while the other two gave sharp structures with well defined angles.

After heat treatment it is seen that both the "fair" and the "cold" give high tensions; the "hot" bar had a small incipient crack which led to fracture. The fractures of all three had a distinctly steely appearance while the "hot" bar showed, besides the small crack, a distinct "direction" of flow in the crystallization which was absent from the other two.

In Table II are given the results obtained with the gray iron.

From this table the strength would seem to have improved by the lowering of the casting temperature. Especially is this noticeable with the "cold" bar. The fracture of this last bar was of a much finer grain or smaller crystallization. From this and his previous researches the author draws the following conclusions:

1. There is undoubtedly a great variation in the strength of cast iron of the same composition as cast.
2. This variation does not appear to follow any distinct rule with regard to the temperature of the casting operations.
3. A difference in mechanical tests is generally accompanied by a difference in microstructure.
4. The inequalities of the metal can be removed by judicious heat treatment.

Table II.

GRAY IRON.

Analyses.

No	CC	Gr	Si	Mn	S	P	Temp.	Condition as	Ult. stress. Pounds.
G	0.52	2.93	2:14	0.11	0.051	0.04	Hot.	Cast.	15,702
H	0.54	2.94	2.14	0.11	0.053	0.04	Fair.	Cast	18,816
I	0.54	2.96	2.14	0.11	0.051	0.04	Cold.	Cast.	29,075
G	0.20	3.21	2.14	0.11	0.053	0.04	Hot.	Heat treated.	6,316
H	0.21	3.22	2.14	0.11	0.053	0.04	Fair.	Heat treated.	7,168
I	0.18	3.17	2.14	0.11	0.052	0.04	Cold.	Heat treated.	8,937

FLUORSPAR PRODUCTION IN 1906.

According to the annual report of the United States Geological Survey there was a heavy decline in the total production of fluorspar in 1906, as compared with the previous year. The total quantity marketed amounted to 40,796 net tons, valued at $244,025, against 57,385 tons valued at $362,488 in 1905. The decline in the output was doubtless due in large part to the overproduction in 1905. As usual, the bulk of the production came from Illinois and Kentucky, the former in 1906, having produced 28,268 net tons. The highest grade of fluorspar, which averages less than one per cent silica, and is white or clear pale blue in color, is sold either ground or in lumps for use in the glass, enameling and chemical industries, the latter including the manufacturing of hydrofluoric acid. The second grade is used by blast furnaces in the production of ferrosilicon and ferro-manganese and in basic open-hearth steel furnaces to give increased fluidity to the slag and to reduce the contents of phosphorus and sulphur. This grade includes colored spar and may run as high as four per cent silica, though mostly sold with a three per cent guaranty.

The lowest grade, gravel spar, including all that containing more than four per cent silica, as well as spar mixed with calcite, is used in iron and brass foundries to make the metal more fluid, and permits the use of larger quantities of lower grades of iron and scrap, as it carries phosphorus, sulphur and other impurities into the slag. Considerable fluorspar is imported, the English product at times selling at a price below that mined in this country.

MUTUAL RELIEF ASSOCIATION.

The second annual meeting of the Reed Foundry Co. Mutual Relief Association, Worcester, Mass., was held recently. A balance of $107.03 in treasury was reported after paying $314 in sick benefits. Officers re-elected are: President, William A. Kennedy; vice president, Frank W. Hill; secretary, Samuel H. Tainter; treasurer, Joseph F. Beeching.

A FLYWHEEL COMPLETED IN RECORD TIME.

The C. & G. Cooper Co., Mt. Vernon, O., has completed in record time the installation of a large flywheel for the Youngstown Iron & Steel Roofing Co., Youngstown, O. The wheel was built to replace one which burst on Aug. 5. The old wheel had been in service a great many years, and with the engine was built in Providence. The order for the new flywheel was given on Aug. 9, with the understanding that it was to be shipped in 26 days. The wheel is 24 feet, 8 inches diameter and weighs 90,000 pounds. It was designed, cast, machined and shipped complete from the works of the Cooper Co. on Aug. 31, or in 18 working days. This anticipated the promised delivery about five days.

A JOBBING FOUNDRY COST SYSTEM*

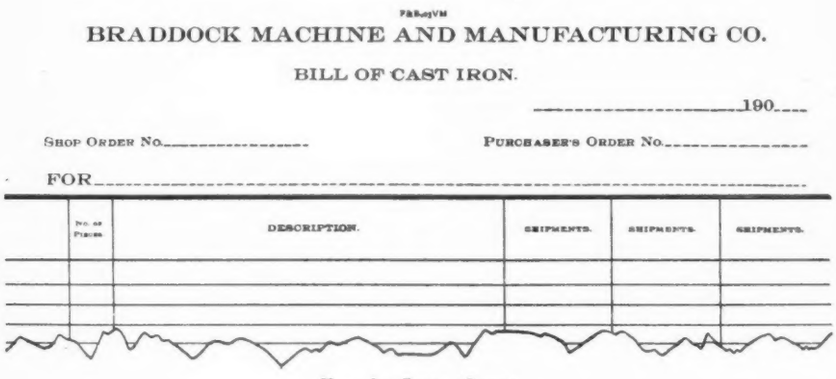
A Simple Method Adopted By The Braddock Foundry & Machine Co.—General Accounts

BY J. F. JOHNSON

THE cost system which I will outline, adopted by the Braddock Foundry & Machine Co., Braddock, Pa., is one that I consider best suited for the general jobbing business, as it permits of many variations to meet different conditions in other plants. It can be adapted for either a large or a small shop,

Jobbing Founders' Cost System.

The work of the cost committee of the Jobbing Founders' Association is to outline a uniform system of foundry cost keeping to meet the requirements of all shops engaged in the production of medium or heavy work, and when a satisfactory system has been found, it will be submitted


BRADDOCK MACHINE AND MANUFACTURING CO.

BILL OF CAST IRON.

190

SHOP ORDER NO. PURCHASER'S ORDER NO.

FOR

No. of Pieces	DESCRIPTION.	SHIPMENTS.	SHIPMENTS.	SHIPMENTS.

FIG. 1—SHOP ORDER

shows absolutely what the castings are costing, and can be maintained with the minimum amount of clerical help. Another advantage is that it is not so complicated but that it can be readily understood by an intelligent employe without a knowledge of bookkeeping. No doubt exceptions will be taken to some parts of the system, but as a whole it is as nearly correct as it can be made.

The foundry business is peculiar in a great many respects and is unlike any other line of manufacture on account of the uncertainties regarding product, amount of material and supplies used on any particular job. This makes it a very difficult matter to get an accurate system of cost keeping. The supplies for any job and the apportionment of indirect charges in the different plants are varied and where applicable to one class of product they do not apply to another. The system which we have adopted meets all of these obstacles and we believe gives us the true cost of manufacture.

*Read before the Pittsburg Foundrymen's Association.

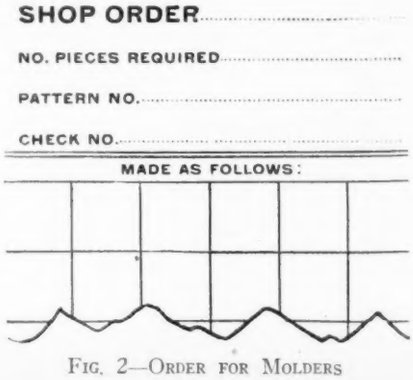
to the various foundries with the request that it be adopted or that their cost methods be patterned after it. We hope in this way to create a better feeling in the foundry business and to avoid the ruinous prices on work that have been prevailing during the past few years. I know of no industry where so much is invested and so little is known as to the actual cost of the product as the foundry trade. The cost committee does not intend to convey the impression that it desires the foundries to adopt any particular method of keeping their accounts. Their bookkeeping ultimately can be done to best meet existing conditions.

In this connection I wish to impress on every foundryman the necessity of having first class clerical help, as without it the best results cannot be obtained from this or any other system.

Archaic Methods.

Most foundrymen are satisfied with one or two men acting in the capacity of foundry clerk, timekeeper, storekeeper, shipping clerk, bookkeeper, and probably stenographer. One cannot expect and secure accurate results from such a working force. The men are without doubt overworked and underpaid. Furthermore, an employe who is able to fill all of these positions satisfactorily would not be engaged in such work, as he could get better remuneration for his services elsewhere. From my observations the foundry business is conducted on the hit or miss plan. Large contracts are taken every day after a mere perusal of the blue prints and prices are quoted at once without an examination into details, such as the amount of loss on account of defective work and other unavoidable causes. It appears to be the general impression that foundry costs are secured by averaging the cost of metal, adding the direct labor and about 75 to 100 per cent for fixed and general charges. This is a great mistake, as I venture to say that no foundry in the country doing a general line of jobbing work can get its indirect expenses as low as 75 per cent of the direct labor. Instead, I believe that these more nearly range from 150 to 200 per cent.

The Jobbing Founders' Association is endeavoring to secure a good system for adoption by the various jobbing concerns, that they may ascertain their true costs and in this way avoid ruinous prices in future. I am certain that no sane man will take a job if he knows before hand that he will lose a certain amount. I have in mind a foundry that has taken work away from us at very low prices,


SHOP ORDER

NO. PIECES REQUIRED

PATTERN NO.

CHECK NO.

MADE AS FOLLOWS:

FIG. 2—ORDER FOR MOLDERS

amounting to more than ½ a cent a pound less than we had been securing. In addition we were so located that our deliveries could be made with teams, while this concern has an extra freight bill against it. I am positive that the operators of this foundry have no idea of the cost of their product, or they would not have taken this work at the prices quoted. The frequent receiverships for foundries of all kinds, and the numerous plants that are offered for sale from time to time, would indicate that the difficulties which beset their operations were due to the sale of their product without a knowledge of its cost.

Shop Order.

The system at our plant we believe encompasses practically every item that should be considered in properly computing the cost of manufacture. The first step is to enter the order by giving it a shop order number and issuing shop bills of material for the different departments. This is universal practice and is generally understood. In addition to this shop order shown in Fig. 1, a small card, Fig. 2, is issued to the molder, which contains the number of the shop order, number of pieces required, pattern number and check number. He is thus better able to report his time on the job and incidentally it affords an additional check on the number of pieces made, as he keeps a record on this card of what he has molded and hands the same to the foundry clerk each evening. This is also a check against the production of castings in excess of this record.

Daily Time Slip.

A daily time slip, Fig. 3, is filled out by each molder after the completion of his day's work and is handed to the foreman before leaving. On this he enters the number of hours engaged on each pattern, the number of pieces molded, the class of work and other information of value in making up the daily time report. This system has been found more satisfactory than to have the foundry clerk take the time, as it gives the latter a check on the time by comparison with his record when the pattern is changed.

F&BMXM07.

DAILY TIME REPORT—FOUNDRY.

EACH WORKMAN IS REQUIRED TO CAREFULLY FILL OUT ONE OF THESE FORMS EACH DAY, AND HAND IT TO HIS FOREMAN BEFORE LEAVING THE WORKS.

BRADDOCK MACHINE AND MANUFACTURING CO.

CHECK No._____ _____ 190____

TIME OF_____ RATE_____ PER HOUR

NO. OF HOURS	ORDER NO.	NO. PIECES	PATTERN NO.	CLASS OF WORK	AMOUNT

_____ TOTAL HOURS. APPROVED. _____ FOREMAN.

FIG. 3—DAILY TIME SLIP

Every day a report is made by the foundry clerk of the castings produced, giving the shop order, number of pieces, pattern number, and the weights of the castings, both good and bad. This form is shown in Fig. 4.

Metal Report.

A record is also made of all the metals charged into the cupola during the month, giving the dates, brands and weights. This can be kept either in book form or on loose sheets. This form is shown in Fig. 5. A store room is also maintained where materials are kept in stock and where they can only be secured by an order from the foreman. A responsible clerk should be in charge, one able to compile a report at the end of each month of all materials used, which should be charged to the proper accounts. True costs cannot be ascertained unless this is done.

FOUNDRY_____

Braddock Machine and Manufacturing Co.

Cast made,_____ 190____

ORDER No.	PIECES	PATTERN.	WEIGHT
Total Weight of Castings			

FIG. 4—REPORT OF DAILY CASTS

Storehouse Supplies.

Fig. 6 shows a form on which is entered all of the storehouse supplies used on the various orders and the storehouse report is shown in Fig. 7. This contains a column for the shop order, the weight of the material, and such storehouse products as have been used, including steel bolts and nuts, lumber, general supplies, brass and bronze, paints, oil and waste, Babbitt metal and foundry supplies. This report is credited every month to the stores' account as well as the various jobs and accounts charged with the same. A periodical inventory is made to compare the actual stock on hand with the book value, which further affords a check on the storekeeper. This may seem unnecessary, but it is found to be a good feature and sometimes prevents theft and careless work.

Distribution of Costs.

As the time slips are received each day in the office after being approved by the foreman they are entered on a distribution or operating sheet, Fig. 8, which contains columns for the shop order, pattern number, class of work and time required, as well as the various amounts. At the end of the month

BRADDOCK MACHINE AND MANUFACTURING COMPANY

METAL CHARGED IN FOUNDRY CUPOLA

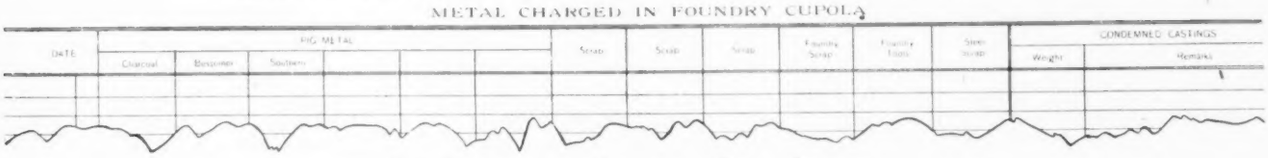


FIG. 5—REPORT OF METAL AND SCRAP CHARGED

ORDER NO. _____ STOREHOUSE SUPPLIES USED _____ 190

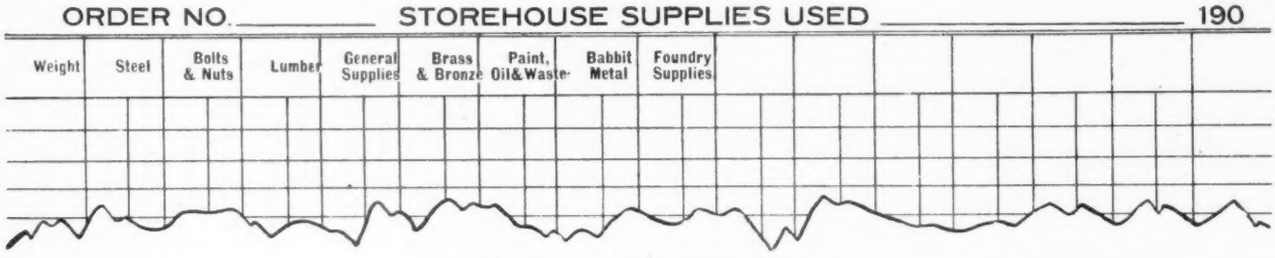


FIG. 6—ORDER FOR STOREHOUSE SUPPLIES

BRADDOCK MACHINE & MANUFACTURING COMPANY.

STOREHOUSE REPORT for _____, 190____

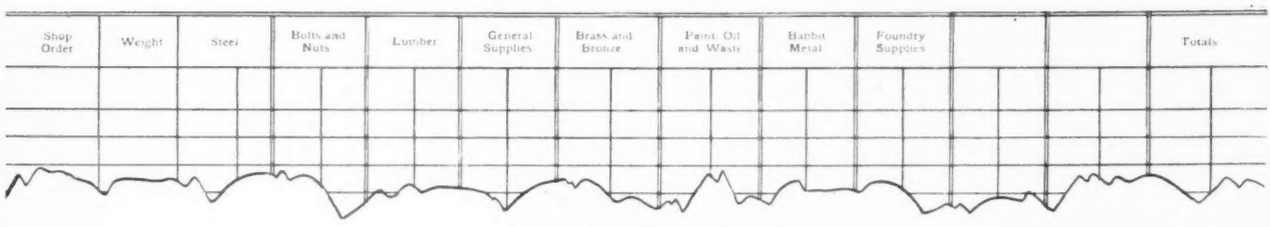


FIG. 7—STOREHOUSE REPORT

these sheets are added and the results are shown on the recapitulation sheet, Fig. 9. This contains the columns for the selling value of each order, the weight of the castings, the metal per pound, the cost of direct labor, the apportionment on the weight per pound and the apportionment on direct labor per cent. On the tonnage basis the following factors are taken into consideration: tools, flasks, supplies, cupola fuel, yard labor, cleaning, coremaking and general labor. The apportionment on the direct labor includes oil, waste, etc., fuel for the ovens, taxes, general expenses, interest, insurance, repairs, foreman and clerk, cupola labor, power and light, crane labor, teaming expenses, fuel for heating, watchman and storekeeper. The cost of the different pattern numbers can be taken from the sheets at any time after the end of the month's work, so as not to delay the closing of the month's business.

Summary of Product.

Another report which we have found of great value is called a summary of the product and is shown in Fig. 10. It gives the average of the number of molders employed, as well as other help throughout the month, with the total of the product, average pounds per molder per day, average weight of the piece for the month, and other useful information for the sake of comparison with other months. We are thus enabled to immediately ascertain if our product is varying and to what extent. This report is self-explanatory and can be compiled very easily.

We now come to the final steps which are arrived at after the books are closed and all expenses determined. It is nothing more nor less than the final recapitulation of the foundry product, showing the costs of the different items as obtained from our books, and as these figures are actual they are bound to be correct. This sheet shows the actual cost of the foundry product for the month, also other items, as well as the practice and average cost per pound. This can be compared with previous months and if operating on the same class of product it keeps a check on the foundry and enables one to ascertain if certain expenses are increasing or decreasing and in what proportion. I would advise all to keep this cost, as the foreman can be called to account, if necessary.

All fixed charges are apportioned on the productive labor, because time is the factor and these expenses are the same whether the output is large or small and the product is also regulated by the time the floor space is occupied by certain pieces of work. All expenses which are regulated by the output should be apportioned on the weight, because weight is the factor and more expense is incurred for the larger pieces.

BRADDOCK MACHINE AND MANUFACTURING CO.

FOUNDRY OPERATING LABOR SHEET.

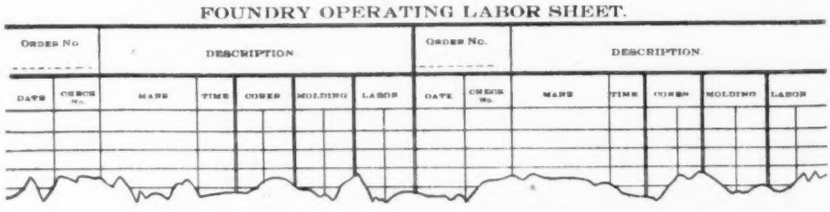


FIG. 8—OPERATING LABOR SHEET

Some may take exception to this method, but I believe it nearer correct than any other I have seen.

General Accounts.

Under the subdivision of "General Accounts" the following charges are made:

Foundry "A" equipment
Foundry "C" equipment
Machine shop equipment
Operating expenses
Foundry tools and flasks
General expenses
Insurance
Contracts
Operating labor
Pig iron
Scrap
Electric light and power plant
Repairs
Store supplies
Taxes
Pattern shop equipment
Blacksmith shop equipment
Teaming expenses
Improvements

General Expense.

The "General Expense" includes the following:

Salaries of officers, clerks, etc.
Stationary and printing
Furniture and fixtures
Advertising
Medical attendance
Office expenses
Traveling expenses

Operating Expenses.

Operating labor, foundry "C":

Foreman and clerk
Molding and casting
Coremaking
Cupola and furnace labor
Crane labor
General labor
Cleaning and shipping

Operating expenses, foundry "C":

Tools
Oils, waste, etc.
Flasks
Supplies
Fuel for cupola
Fuel for ovens
Fuel for heating

Repairs.

Repairs, foundry "C":

Buildings, etc.
Cupola and ovens

SUMMARY OF FOUNDRY PRODUCT..... .....190..

Average Number Molders during Month - - - - - .....
" " Men " " - - - - - .....

Product for Month - - - - - - - - - - - - - - .....Lbs.
Number Pieces for Month - - - - - - - - - - - - .....

AVERAGE

Pounds per Molder per Day - - - - - - - - - - .....
Pieces " " " " - - - - - - - - - - - - .....

Pounds per Man per Day - - - - - - - - - - - .....
Pieces " " " " - - - - - - - - - - - - .....

Average Weight of Piece for Month - - - - - - - .....Lbs.
Average Molder's Wages per Day - - - - -
Average Molder's Wages per Lb. Product - - - - - $.....
.....Cts. Lb.

DESCRIPTION OF EXPENSE

GENERAL

General Expenses, Salaries, etc.
Interest, Insurance and Taxes
Teaming Expenses
Yard Labor
Watchman and Assistant Storekeeper

OPERATING LABOR

Foremen and Clerk
Moulding and Casting
Core Making
Cupola and Furnace Labor
Cleaning and Shipping
General Labor
Crane Labor

REPAIRS

Buildings
Equipment

RUNNING EXPENSES

Tools
Oils, Waste, etc.
Flasks
Supplies
Fuel for Cupola
" " Ovens
" " Heating
Electric Light and Power

MATERIALS

Pig Iron	Lbs.	@	Gross Ton
Foundry Scrap	"	@	" "
Bought "	"	@	" "
_____	"	@	" "
Cupola Charge	Lbs. Totals		

PRODUCT

	Lbs. Castings	@	c. Lb.
_____	" Defective Castings	@	"
	Lbs. Total		

SUMMARY OF PRACTICE

Lbs.	Castings	=	per cent
"	Scrap	=	per cent
_____	" Waste	=	_____ per cent
"	Total	=	per cent

FIG. 10—SUMMARY OF FOUNDRY PRODUCT

Cranes
Ladles, scales and pit
Blowers and motor
Elevators
Tumbling barrel and sifter
Air furnace
Molding machine
Rip saw and connections

Pattern shop operating labor:

Pattern labor
Checking patterns
Repairing patterns
General labor

Pattern shop repairs:

Saws, planers and lathe
Miscellaneous

Pattern shop operating expenses:

Tools
Supplies
Fuel

Electric light and power plant:

Operating labor
Tools
Oils, waste, etc.
Repairs, including labor and material
Electric current purchased
Lamps, globes, carbons, etc.

BRADDOCK MACHINE AND MANUFACTURING CO.

SUMMARY OF FOUNDRY PRODUCT. ----------1907

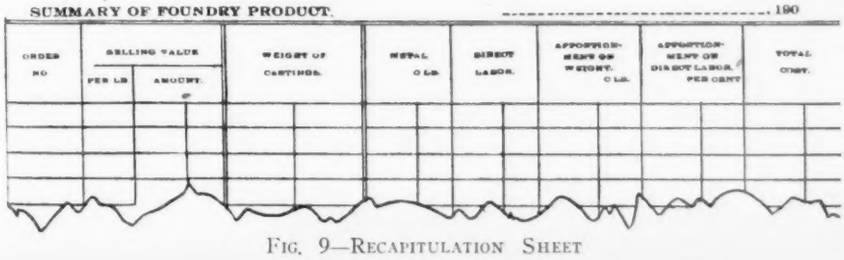


FIG. 9—RECAPITULATION SHEET

Martin Fox

"It has been my purpose to give the Iron Molders' Union of North America, and its officers, a reputation for honesty and fair dealing in the business world, and even though it might temporarily advantage our interests, I have consistently refused to do aught that would savor of bad faith and double dealing."—MARTIN FOX.

FTER a number of years of illness, accompanied by intense suffering due to inflammatory rheumatism and lung disease, Martin Fox, formerly president of the Iron Molders' Union of North America, died at noon, Sept. 28, at his home in Cincinnati. The possibility that the condition of his health might compel him to resign the presidency of the union was discussed for two years prior to July, 1903, when his resignation was formally presented to the executive board of the union, and it took effect shortly thereafter. This action was taken in the face of strong urging from his associates to continue, added to the assurance that such help as he might need would be provided, to relieve him of the brunt of the president's burdens. For a time Mr. Fox assisted in the care of a number of matters which were then pressing upon the attention of his official associates, and he continued to serve in an advisory capacity up to the time of his death.

Martin Fox was born in Cincinnati in 1848. He served an apprenticeship to iron molding in Resor's foundry and worked continuously at that trade until he became officially connected with the Iron Molders' Union of North America. In 1880, P. F. Fitzpatrick, president of the union, appointed Mr. Fox as his clerk and in 1886 the union created the office of secretary, electing Mr. Fox to fill the position. His executive ability soon made itself felt and it was no surprise when, on Mr. Fitzpatrick's retirement in 1890, the Detroit convention of the Iron Molders' Union made Martin Fox its official head.

Always a friend of peace, one of the first acts of Mr. Fox as president was to enter into negotiations with the Stove Founders' National Defense Association with a view to ending the interminable conflicts between the organized iron molders and the stove manufacturers, which had sadly handicapped the stove manufacturing industry during the eighties. In these efforts he had the hearty cooperation of Henry Cribben, then president of the defense association, with the result that in 1891 the foundation of what are known as the conference agreements were laid at a meeting of representatives of the two organizations in Chicago. Under this arrangement there must be neither a strike nor a lockout until investigation has been made by impartial representatives of both associations.

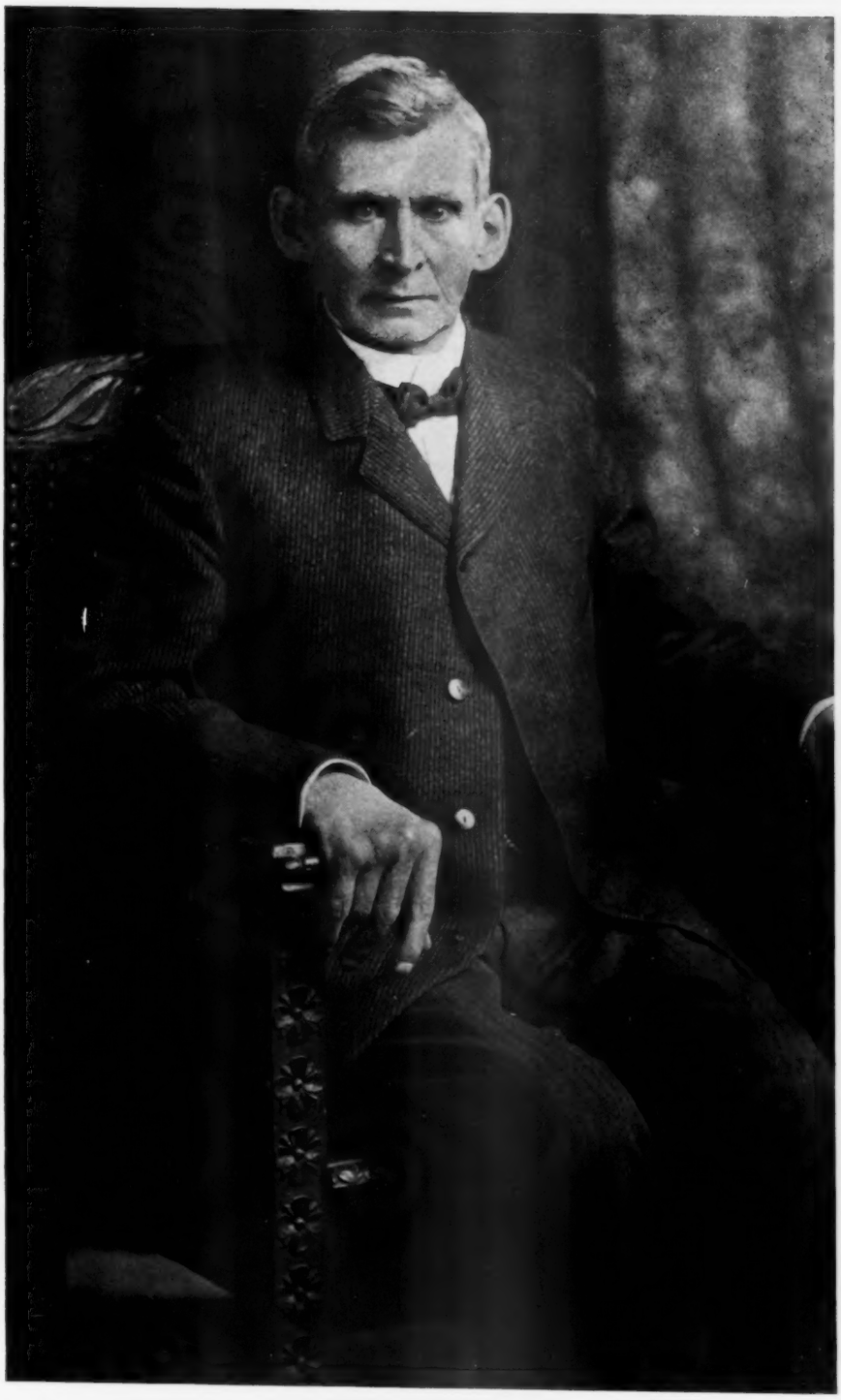
Conciliation, as applied to industrial disputes, was not so much talked of in 1891 as it is today and in its advocacy Mr. Fox had to face the bitter opposition and harsh criticism of many members of his union. But, despite all opposition, he succeeded in bringing about the ratification of what is conceded to be the first undertaking in the United States between associated manufacturers and organized workmen, whereby both parties were pledged to arbitrate their differences.

In 1895, 1899 and 1902 he was successively reelected to the presidency of the Iron Molders' Union. During these years he not only piloted it through one of the most trying periods of its history and made it one of the most substantial trade unions in the country, but won for himself and his organization the respect of American foundrymen. Shortly after the organization of the National Founders' Association, it will be remembered, Mr. Fox made advances to the representatives of that association with a view to still further applying the principles of peace and conciliation. The New York agreement of 1899 was the result. Not only on the question of arbitration of disputes did Mr. Fox take advanced ground, but his attitude upon the molding machine question, apprentice ratio and other vital issues marked him as an advanced thinker in the labor world, and, though conservative in many respects, he was progressive and broad-minded when considering the problems which confront American industries.

Fidelity to principle and to obligation, firmness, and a high sense of justice marked Mr. Fox's official career. Though one of the strongest characters among American trade union leaders, his retiring disposition made him averse to notoriety. He devoted himself to the Iron Molders' Union and never sought in a wider constituency to command applause or attract admiration. Not the least of his powers was his ability to secure the willing, loyal support of his associates, this contributing in no small degree to the success of his administration.

Mr. Fox was well known among the foundrymen of the United States and Canada and was held in very high esteem by all who had any dealings with him. His name was universally regarded as a symbol of good faith and fairness and it may well be said that the whole foundry industry regretted the necessity of his premature retirement from active leadership and now mourn his death.

(The likeness of Martin Fox on the opposite page was reproduced from a photograph made shortly before his death.)



Martin Lost

LOCATION OF THE PATTERN SHOP

This is the First of a Series of Articles Relating to the Operation and Management of the Pattern Shop

BY OSCAR E. PERRIGO

THE installation of manufacturing plants in buildings not well adapted for the requirements of the business to be carried on not only increases the operating cost, but incurs many inconveniences that in the beginning are not apparent. Frequently a larger force of men must be employed than is absolutely necessary, and if the departments are not located in proper relation to each other, much time is consumed by the superintendents and foremen in following up work, that could more profitably be spent in other ways.

Location of the Pattern Shop.

The dust from the pattern shop may be an objection to its location next to the drafting room, but there are more serious reasons why the pattern shop should not be located on a floor above the foundry. The disagreeable gases generated in the foundry rise and fill the pattern shop, while the dust when shaking out enters every crevice in the pattern room and makes life unbearable for the patternmakers. The frequent changes of temperature in the foundry and the moisture in the atmosphere from the steam arising from the molding floors causes a continual expansion and contraction of the dried pattern lumber, and first-class pattern work becomes extremely difficult.

To avoid the expense of transportation when a large number of changes are to be made on ordinary patterns for the purpose of producing a small number of castings, it may be advisable to provide a small room connected with the foundry for such work, particularly if it is of a rough character, but there will be little rivalry among the patternmakers for such a job.

Pattern Changes.

Large patterns, requiring minor repairs or changes, may sometimes be worked upon in the foundry to avoid the expense of carrying them to and from the pattern shop, but when the difference in the wages of the patternmaker to do this work, and that of the laborers to move the patterns, and the inconvenience to the patternmaker in doing work outside of his shop are considered, it will usually be found more economical and much more satisfactory to send the pattern to the pattern shop, except, of course, in cases where the molding of the pattern is in progress and it cannot be removed from the flask. In discussing the location of the pattern shop, it has been suggested that there is a good reason for placing it on the ground floor, where better foundations could be provided for such machines as large face plate lathes, planers, and other heavy and high speed wood working machines. In considering this it may be said that properly balanced machinery is not liable

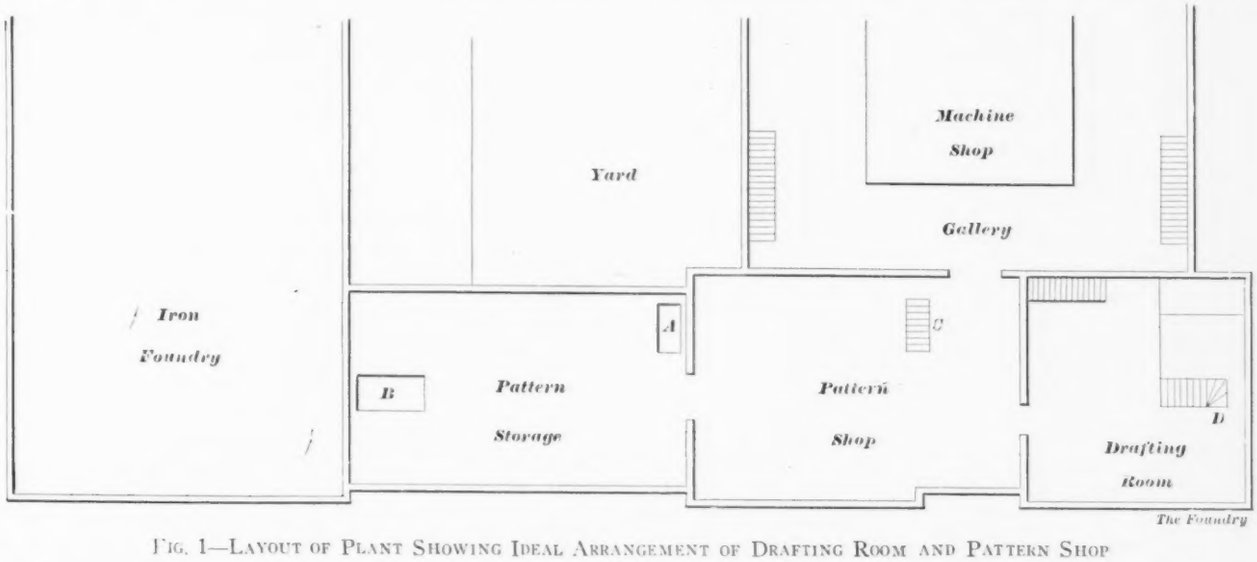


FIG. 1—LAYOUT OF PLANT SHOWING IDEAL ARRANGEMENT OF DRAFTING ROOM AND PATTERN SHOP

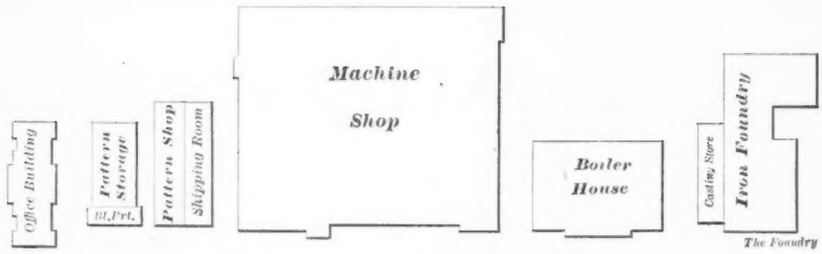


FIG. 2—LAYOUT OF AN ENGLISH PLANT

to give trouble from vibration even at high speeds. But on the other hand, large patterns on the face plate do not balance when the first turning operation is commenced and before they are reduced to circular lines. The vibration can always be kept within safe limits by properly reducing the speed.

Important Reasons.

The more important reasons for not locating the pattern shop on the ground floor are:

First.—All the space on the first floor is usually required for such heavy machine shop tools as large planers, lathes, boring mills, radial drills and similar tools.

Second.—There is not usually as much light on the first floor as on the floors above.

Third.—A pattern shop adjoining a machine shop on one or more sides and often having similar departments over it, is liable to annoyance from "machine shop dirt" as the patternmakers style it, and which is very disagreeable as well as detrimental to good pattern work.

Fourth.—As the drafting room is seldom placed on the ground floor, and as this department and the pattern shop should be near each other, both should be located nearer the top of the building.

It is often said that we learn as much from one failure as from two successes. While this probably refers to our own experiences we should learn much from the experiences of others by observing their efforts and the results, whether successful or otherwise. In considering this question we should note some of the plans of manufacturing plants and the results accruing from unsatisfactory arrangement of various departments.

Poor Location.

Fig. 5 shows the plan of a plant that tells its own story. The pattern shop is on the second floor and the drafting room on the third floor of the office building at A.

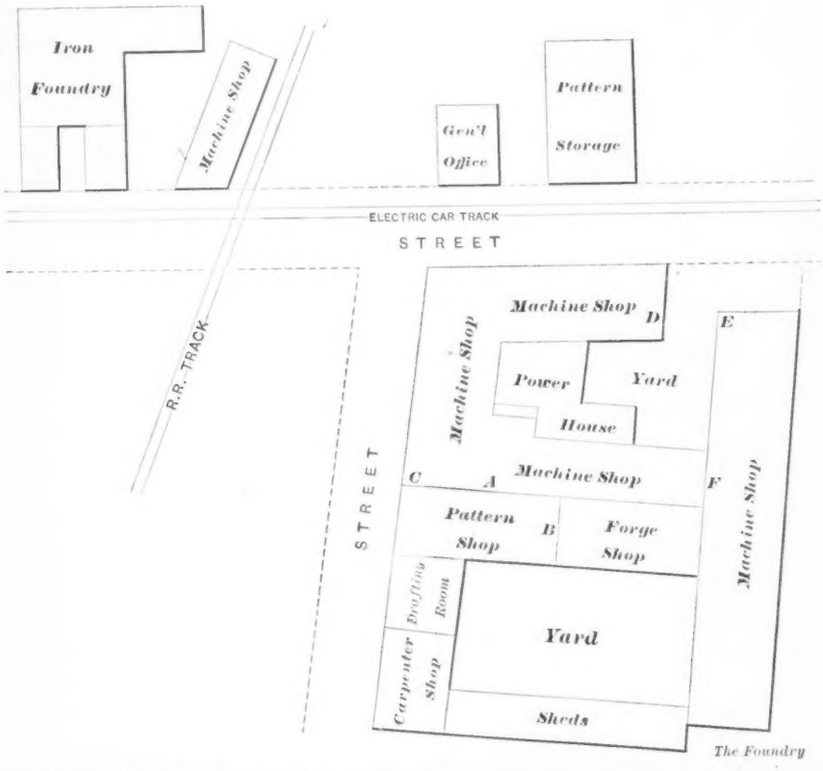


FIG. 3—LAYOUT SHOWING FOUNDRY AND PATTERN SHOP WIDELY SEPARATED

The distance from the pattern shop to the pattern storage shown by the dotted line A is 800 feet, and as shown crosses two railroad tracks, on one of which passenger and freight trains pass at frequent intervals. The distance by the same route to the foundry door is 650 feet, while to the front door of the machine shop by the dotted line b, is 450 feet and crosses three railroad tracks. To improve these conditions and bring these departments within more convenient reach of the superintendent, as well as each other, the drafting room and pattern shop were removed to the front end of the machine shop at B, the pattern shop being located on the upper of the three floors, all of which communicated with the front platform by a large elevator. Patterns were then taken by the route C, 20 feet to the iron foundry, and by route D, 500 feet to the pattern storage building, while communication with all parts of the machine shop was readily had without going out of doors.

English Plant.

Fig. 2 shows the plan of an English plant. From the fact that a blue print room is shown in the pattern storage building it is probable that the drafting room is close to it, probably in the large office building. The pattern shop and pattern storage building are convenient to each other, but the foundry is nearly a thousand feet away and there seems no particular reason why it should not have been located much more conveniently.

Fig. 3 shows a plant that in a general way is very compact, but as far as the pattern shop, pattern storage and the iron foundry are concerned, is very awkwardly arranged. The drafting room is located on the second floor, over a gateway giving access to the yard and the buildings facing it and the pattern shop is also on the second floor of the adjoining building, and nearly on a level with it. It will be seen that to reach the iron foundry or the pattern storage, street car tracks must be crossed. The pattern storage building should have been erected upon the location of the forge shop and that department placed where the sheds are now placed.

To reach the machine shop in the same level, instead of a convenient door at A, the patternmakers are obliged to descend a stairway at B, pass to C, and go up another flight of stairs. This obviates the expense of a fire door at A, to which the company objected. The same condition existed at D E, but a foot bridge was

finally constructed after 15 years of discussion as to its advisability, and a door was cut through at F, to further facilitate communication.

Another Poor Layout.

Fig. 4 shows an arrangement that is hardly excusable. The location of the drafting room, vaults and dark room on one side of the building and the pattern shop on the other. The pattern shop should have been on the same side as the drafting room and direct communication arranged between them by placing the tool room beyond the pattern shop.

Ideal Arrangement.

Fig. 1 shows an ideal arrangement so far as convenience of communication with the other departments is concerned. The drafting room, pattern shop and pattern storage room are all on the second floor; at A, is a trap door through which lumber is received from the yard; at B is another and larger trap door through which patterns are lowered into the flask room adjoining the iron foundry. Communication with the machine shop is had by means of a door opening upon the galleries and stairs to the first floor, or, by the stairs C, to the tool rooms and the stair D, to the offices.

The main traveling crane in the machine shop will move heavy patterns, etc., to and from the front gallery. The door between the pattern shop and pattern storage room closes automatically and all the cross walls extend above the roof for additional fire protection.

Conclusion.

From the foregoing we can summarize the requirements for the location of the departments considered as follows:

First.—The pattern shop and drafting room should be near each other and convenient to the superintendent's office.

Second.—The pattern shop should be located as near the iron foundry as possible but not in the same building.

Third.—The pattern storage room should be conveniently located for both the pattern shop and the foundry, preferably between them. It should be fire-proof and this may necessitate the erection of a detached building.

CLEAN IRON.

Question:—We are using about 4½ per cent of ferro-silicon which we place in the bottom of a one-ton ladle and serve the hand ladles from that. Our iron seems soft and strong and we tap threads at high speed. The only difficulty we experience is that the crust on the ladle breaks up and some of it gets into the casting. Is it possible to add some alloy or substance which would flux and keep the slag in a compact mass in the ladle?

Answer:—The cheapest substance which will flux and keep the scoria and dirt always forming and floating on molten iron in a compact mass in the ladle is fine dry sharp sand sprinkled on the surface liberally. This partly melts and forms a glassy surface quite plastic and sticky, it becomes a floating skimmer. The oxygen of the air unites instantly with molten iron as fresh surfaces are continually forming a thick skin. In order to insure clean castings poured from hand ladles it is not sufficient to skim the iron in the large ladle, but a little sharp sand should be sprinkled over the surface of the iron in the hand ladles just before pouring to keep the iron oxide which has formed from passing into the mold. Careful molders keep a box of clean sand at hand for this purpose, careless molders sometimes throw a handful of floor sand and dirt on the surface of the metal and then complain of "dirty iron."

In well conducted foundries iron skimming rods flattened into a kind of spoon shape on one end are provided to skim back the floating scoria or dirt from the lips of the ladles before sprinkling the surface with clean fine, sharp sand.

Powdered borax has been used in the same way as fine, sharp sand but it gives no better results and costs more.

ALEX. E. OUTERBRIDGE JR.

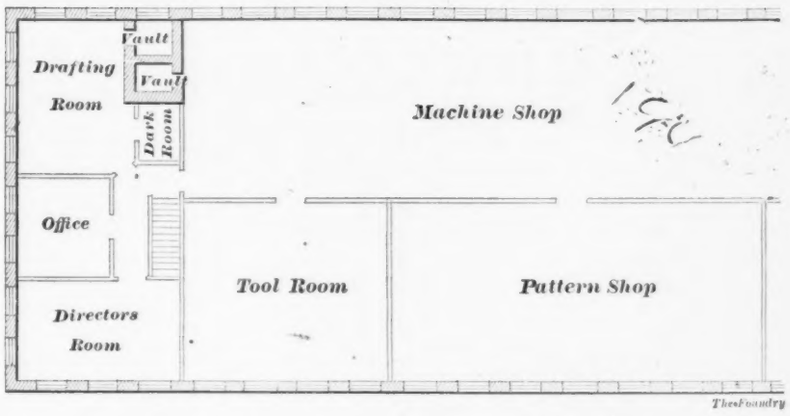


FIG. 4—ANOTHER LAYOUT SHOWING IMPROPER ARRANGEMENT OF DRAFTING ROOM AND PATTERN SHOP

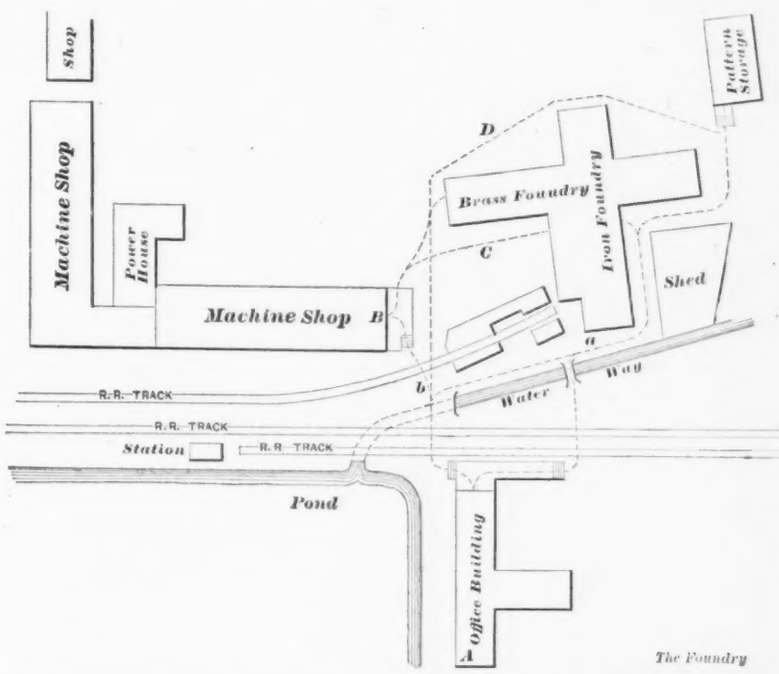


FIG. 5—IMPROPER LAYOUT, DISTANCE BETWEEN PATTERN SHOP AND PATTERN STORAGE, 800 FEET

SASH WEIGHTS CAST IN CHILLS

Novel Equipment for the Rapid Production of Weights—Method of Operation—Raw Material

OF THE many desirable and profitable gray iron specialties, none would compare with the sash weight, but for the fact that its selling price is rarely above the market value of pig iron. Yet this seemingly insurmountable obstacle to fortune and fame in the foundry business has evidently been successfully solved by many concerns, as the annual production of weights in this country is now placed at over 85,000 tons. The bulk of the castings are still made in green sand molds, which are stacked, while the molding is done almost entirely by machinery.

Modern Sash Weight Equipment.

At the plant of the Johnston & Jennings Co., Cleveland, the weights are made in chills and the success of the venture can be measured by the annual output, which is now close to 10,000 tons. The manufacture of sash weights is, however, only a side line with this concern and this department occupies only 1,800 square feet of floor space of the large and commodious foundry, which is 250 x 110 feet in size. In addition to the foundry, which is devoted to heavy jobbing work and machinery castings of all kinds, the plant includes a machine shop, detinning works and power house.

The Chills.

The chills are arranged in four batteries, as shown in Fig. 1. There are two rows of 12 chills in each battery, making a total of 96 chills. As shown in Fig. 3, the chills are made in two sections, are hinged and contain the molds for two sash weights each. The molds are vertical and the inside sections of the chills are fixed, while the outer halves swing on hinges. All of the chills are water cooled, a 2-inch supply pipe extending between the rows of each battery. Each chill is connected with the main by a half-inch pipe, and the swinging halves are connected with the water main by a flexible hose. The chills are cored to form a water space about one inch wide, having a division in the center to strengthen the section. After passing through the chills the water is discharged into a trough or gutter extending between the rows of each battery and flows into a well from which it is pumped back into the chills again. By this method the consumption of the water has been reduced to the minimum.

Operation.

Overhead tramrails connected with the main tramway from the cupola extend over each battery as shown in Figs. 1 and 2. The ladles, after being filled at the cupola, are lifted up on the bail depending from the trolley track and are conveyed to the sash weight molding floor. The iron is poured through bell shaped open-

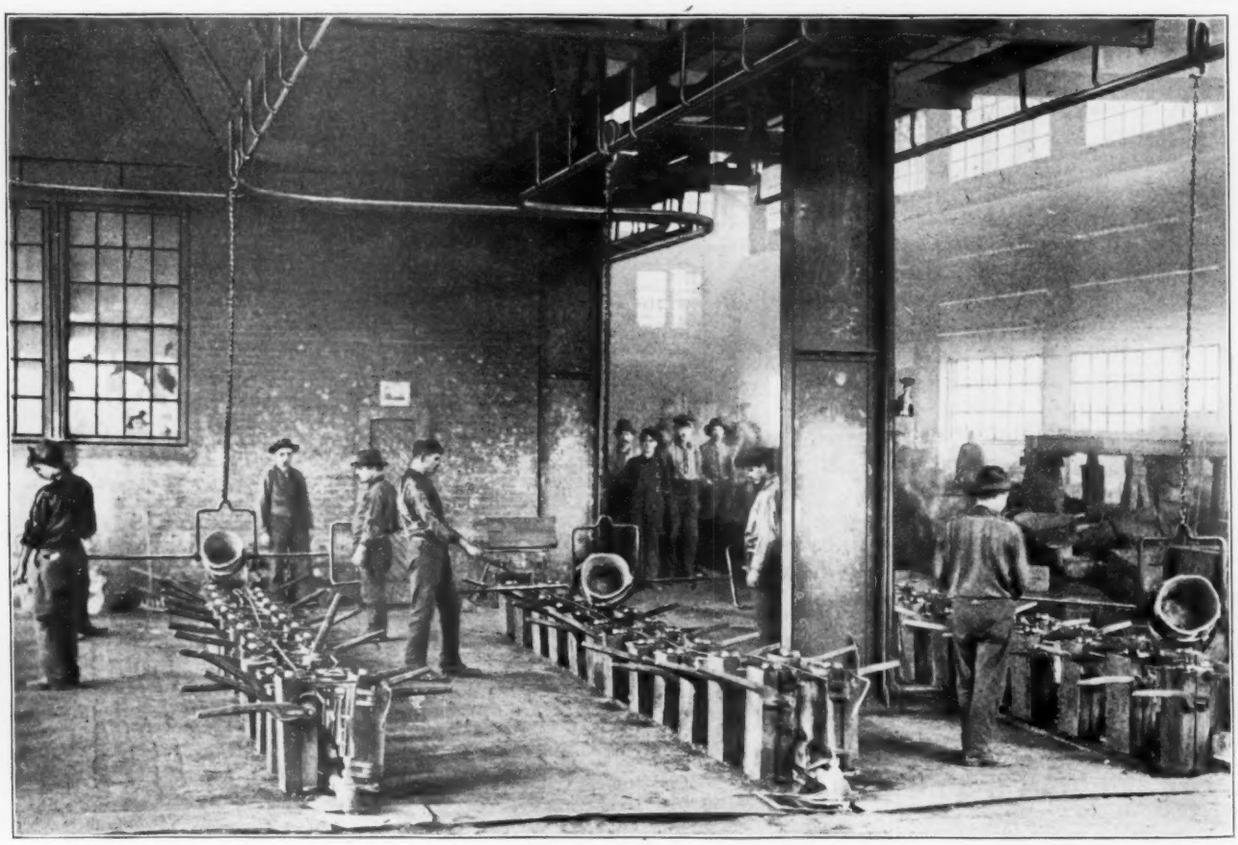
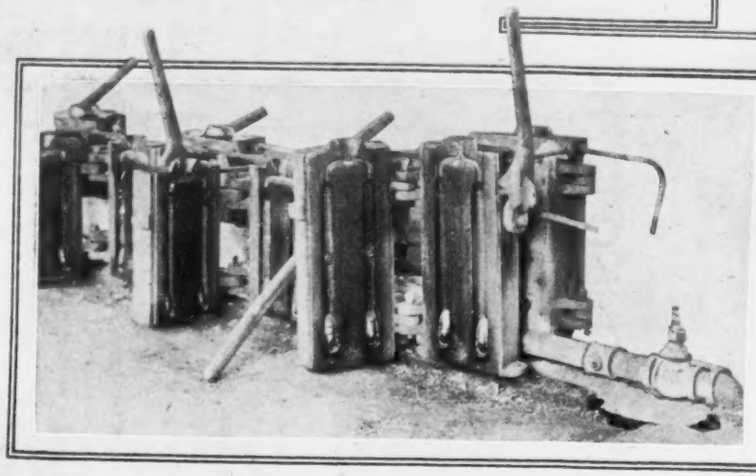


FIG. 1—SASH WEIGHT FLOOR SHOWING ARRANGEMENT OF THE CHILLS



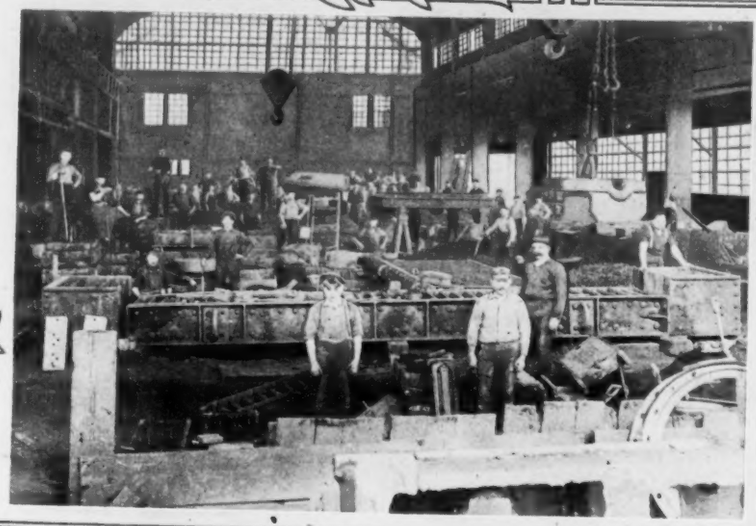


FIG. 2—ANOTHER VIEW OF THE SASH WEIGHT FLOOR SHOWING THE METHOD OF HANDLING THE IRON

FIG. 3—VIEW OF THE CHILLS

FIG. 4—SASH WEIGHT MOLDING FLOOR

FIG. 5—GENERAL VIEW OF THE FOUNDRY

ings in the tops of the chills, and after two or three have been poured, a laborer lifts up the handle that serves as a clamp, opens the chill and knocks out the castings with a slight tap on the sprue. To prevent the castings from falling on the floor they are caught on a hook and are dropped gently to prevent breaking. The chills are then closed by a boy and are ready for the next iron. Each battery is operated by three men and a boy. Two of the men pour the iron, while the third knocks out the castings and the boy closes the chills and knocks off the runners and sprues. Pouring begins at about 11 o'clock in the morning and continues until 5 o'clock in the afternoon. The iron is melted in one of the two 84-inch cupolas installed in the foundry and the output of this floor is about 25 tons daily.

Equipment.

The cost of equipping a plant of this kind is naturally heavy, as chills are required for each of the various sizes of weights, ranging from 3 to 17 pounds. From 3 to 12 pounds there are 19 sizes, and five from 12 to 17 pounds. The faces of the chills are machined to insure a close fit and to eliminate fins as far as possible. While the molds are not finished, great care is exercised in casting the chills to insure smooth molding surfaces. The molds are oiled each night to prevent the formation of rust which would soon ruin their smooth surfaces. The hole in the sash weight is made by the shoulders on the two halves of the molds, which can be plainly seen in Fig. 3. As the shrinkage is necessarily great, the castings are knocked out immediately after the iron has set. Whatever breakage results from this cause occurs near the runners and the weights can still be disposed of as seconds.

Raw Material.

Upon the selection of the raw material for the cupola hinges the success or failure of every venture in the sash weight line. All kinds of low grade scrap can be used and the despised tin can has likewise been bundled to make up the charges. At this plant, cast house slag is used as well as low grade scrap, and the cost of the iron is therefore considerably lower than the prevailing price of pig metal. Cast house slag should not be confounded with the ordinary blast furnace product, which is too low in iron to make its remelting profitable. Nor are tin clippings and tin cans used as freely as heretofore, as the detinned steel has a market value considerably above the lowest grade of scrap.

The stock of sash weights carried at this plant is prodigious, often amounting to nearly 1,000 tons. Shipments, except to local points, are nearly all made in carload lots, and practically all of the various sizes are frequently specified.

For making heavy weights up to 20 pounds, the molds are made in green sand. This floor is shown in Fig. 3. The patterns are mounted on a stripping plate machine, six molds to the flask. The flasks are stacked four high, and this necessitates the clamping of only the top flasks of each stack.

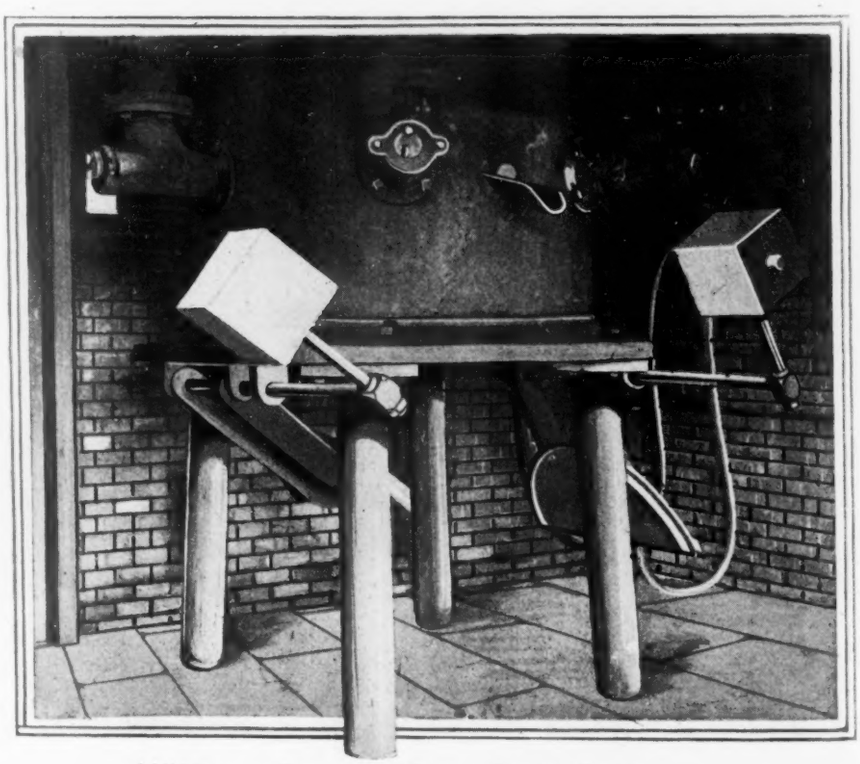
The Foundry.

The foundry, Fig. 5, is unusually well equipped for heavy work, the middle bay being served by two 20-ton electric traveling cranes. In addition, five jib cranes are provided which can be attached to any of the columns in the shop. They are operated by hand and have a capacity of 5 tons each. The core room is 75 x 40 feet and is equipped with a Standard sand mixer and a Wadsworth core machine. Natural gas is used for skin drying the molds, and pneumatic tools are used entirely for cleaning the castings. The melting equipment consists of two 84-inch cupolas, one being constantly operated on iron for the sash weight floors. The charging floor is served by an electric elevator.

BOTTOM DOOR CLOSING DEVICE

A CLOSING device for cupola bottom doors, which has been in successful use for more than two years in the foundry of the Dominion Coal Co., Ltd., Glace Bay, Nova Scotia, is shown in the accompanying illustration. The doors are merely counterbalanced and a pressure of 50 pounds will swing each door into place. While adjusting the prop, a weight of 50 pounds placed on each counterbalance will hold the doors in position. The use of an additional weight can, however, be dispensed with, providing a nut is cast on the counterbalance and the thread cut on the outer end of the lever. This will make the weight adjustable. The prop should be constructed with a knuckle joint at the center secured with a key similar to that used for locking a crane ladle.

DANIEL BELL.



CLOSING DEVICE FOR CUPOLA BOTTOM DOORS

THE JOBBING BRASS FOUNDRY

This Will be Followed by Articles on Mixtures, Jobs, Equipment, Management and Prices

BY J. F. BUCHANAN

THE brass foundry is the pioneer of all branches of the casting industry and its genesis is very remote. The beginning of metal founding was necessarily very crude. The primitive foundry undoubtedly consisted of an argillaceous sand bed surrounded by overhanging rocks. The metal was some native ore; the fuel, brushwood; the mold, dried clay; the patterns undoubtedly some specimens of natural history, such as the Chinese and Indians still cast to this day; the tools, flesh, bone and stone, especially the latter. Our industry originated with such primitive methods, and the evolution, to say the least, has been rapid. The jobbing foundry is the casting plant under normal conditions, where molding combines manual dexterity with expert knowledge.

Types of Jobbing Foundries.

There are two kinds of foundries worthy of consideration: First—The job foundry and a special job shop. From the time of Aaron to the close of the Grecian period, the jobbing foundry was paramount. The Athenians were the first to specialize in the foundry field, when at the dawn of the Christian era, they manufactured bronze images in large lots. Through the Renaissance period and the beginning of the iron age foundry work was devoted largely to the production of articles of general utility and in the constructive arts. Whatever of grace may have survived is now kept out of the jobbing foundry. A long period has elapsed since the advent of the first foundryman to the multiple molder—from Aaron to the new lever action expert, who has just been added to the "Automatic Foundry Co.'s" pay roll. However, the jobbing molder, as we know him, continues to be the handyman of the foundry trade. He is called upon to make every conceivable kind of a mold and the more difficult the job the greater will be his ingenuity in performing it. When a demand is made for good molders, the job foundry is called upon to furnish the man. More real molding is done in the jobbing foundry than in any other kind of a casting plant. A molder, who can successfully hold a position in the jobbing foundry, is necessarily versatile and an experienced mechanic. The specialty shop is a school for economy, while the jobbing shop is a school for molders. To strike a happy medium is the aim of every conscientious foundryman who arranges his layout for general foundry work. There is no distinctive style for the jobbing foundry and the scope is wide for originality and skill. The same castings are often produced by totally different methods, varying according to the practice of the foundries in which they are made. This individuality of effort has a tendency to give the jobbing molder confidence and a superior knowledge of the first principles of his trade. The machine molders and foundry specialists have a tendency to work in grooves and the machines reduce the human factor in the work. It cannot be denied that there is an enormous gain in automatic production, but we should never overlook the debit side, and so far as the molders are concerned we must charge up to the machine the loss of initiative and fertility of resource of the man operating it, which to the foundryman, are all important.

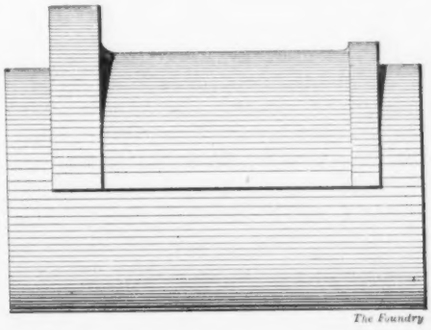


FIG. 2—SIDE VIEW OF PATTERN

Labor Saving Devices.

The manager of a modern jobbing foundry cannot expect to win out on a *laissez faire* system, neither can he hope to attain the systematized perfection which characterizes operations in the automatic machine molding shop. The discussion of hand versus machine work does not concern the executive department, except as it effects preparatory work for making the molds and the cleaning of the castings. Labor saving tools, machines, appliances and economical methods, are just as essential in the modern jobbing foundry as they are in the specialty shop and can be applied to every part of the work except the actual

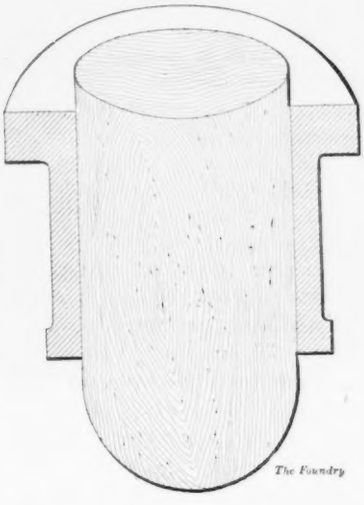


FIG. 1—FRONT VIEW OF PATTERN

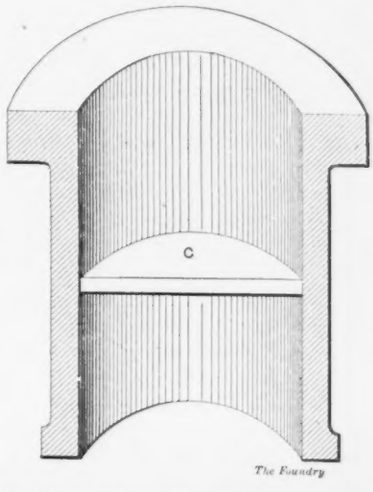


FIG. 3—PATTERN PROPERLY CONSTRUCTED

molding. The introduction of pneumatic rammers and chippers, electric and air hoists, core machines, portable melting furnaces and core ovens, sand elevators, sifters and mixers, exhaust tumbling barrels, magnetic separators, sprue cutters, wire straighteners, trolley tracks, mold drying machines, car ladles, liquid core mixtures, parting compounds and last, but not least, ready made alloys, have revolutionized general foundry practice and have changed conditions formerly surrounding operations in the jobbing brass foundry. These appliances have increased the efficiency of the brass molding shops, have had a tendency to reduce the cost of castings, and the adoption of modern tools have reflected credit on many concerns.

New Problems.

Under modern conditions the foundry industry presents new and ever increasing problems. The scope of

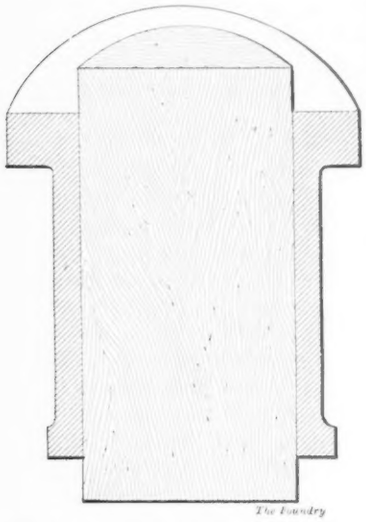


FIG. 4—PATTERN WITH HALF PRINT

the industry is constantly growing and former methods are becoming obsolete. The rapidity with which new appliances and methods have been adopted by the foundry trade is one of the miracles of the present industrial evolution. Machinery has done what no other force could do. It has divided the metal casting industry into a number of well ordered sections; it has eliminated guesswork; it has taken on the hard work of molding without greatly detracting from the skill of the molder; it has made foundry engineering a real business indispensible to the progressive firms. Foundry cost accounting, one of the essentials for successful foundry work, has likewise been introduced and "foundryology," long considered, a theory has at last become a fact. The foundrymen are in the hands of

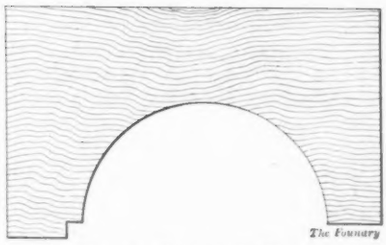


FIG. 5—STRICKLE BOARD

the supplymen, the metallurgists, the cost accountants and all the experts of the technological brotherhood. No branch of the foundry industry, not even the despised job shop, can be operated without their guidance. We admit it grudgingly, may be, but with a dignified reserve, the scientific spirit has penetrated even to the jobbing foundry. When we consider the old time prejudices which have been carried forward from the hoary ages of founding, as it was and ever should be, we should be thankful that the spell has been broken and that we can never return to the "cast as best you can" method. The passing of these patriarchal conditions, and the universal adoption of improvements mark the new palpitant era of foundry practice and reveal the modern foundryman of affairs, who is able to link the theoretical with the practical. Such is the foundry manager of today—a keen observer, alert to the smallest details of the business philosophy and a practical guide in the art of doing things well.

Brass Foundry Jobs.

Returning to a discussion of the jobbing brass foundry, we should first consider the jobs. There are all kinds, including the jobbing shop jobs—single, special, hard and soft, those that nobody else will undertake, patternmakers', foundry students' jobs

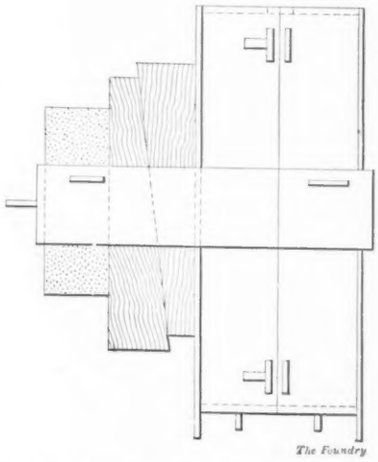


FIG. 6—METHOD OF BINDING A FLASK FREQUENTLY RESORTED TO

and just plain every day work. The first selection is that of the foundry student's job; it is an easy piece of work made difficult. The patterns were received from the local university where the engineering school boasts of a pattern shop but has no foundry. Figs. 1 and 2 show front and side views of the pattern. Evidently the student who made the pattern was impressed with the elementary rule, that to produce a hole in a casting a core is required in the mold and that the same generally calls for a print, a whole print and nothing but a print on the pattern. It can readily be seen that the print in this case caused all the difficulty. The casting is just an ordinary half collar or gland bush, weighing about 40 pounds. Four pieces were ordered to complete the two glands. No other method having been shown, they were made with full cores, one-half of the print being bed-

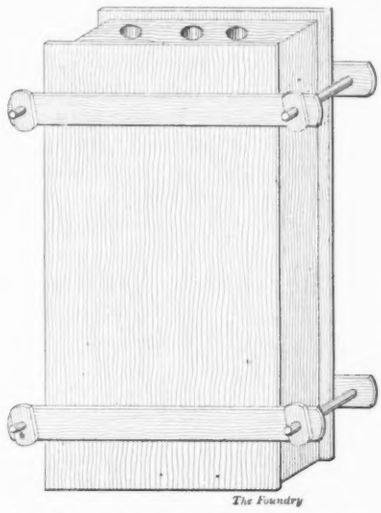


FIG. 7—PROPER METHOD OF BINDING FLASK

ded in the floor to form the drag. The labor expense entailed in molding these four castings was almost double what it would have been if the patternmaker had made the pattern. If an experienced man had done the work the pattern would have been made as shown in Fig. 3, and in all probability he would have made a loose stiffening bar C, to avoid ramming in. No print is required, no coremaking and no fitting on; only a plain half bush that any boy could make.

Another Method.

An alternative method of making the pattern is shown in Figs. 4 and 5. Even this would be cheaper and safer than the one made by the student. Fig. 4 shows the pattern half printed that is, with only half a print, and

Fig. 5 is a strickle board to make the half core. There is no need of dwelling on this simple every day job. It was closer because it had just been received in the foundry and shows how the simplest piece of work may be elaborated by the inexperienced.

Mixtures.

Jobbing brass foundry mixtures—what are they? We can best answer this by showing what they are not. First of all, they are not standard alloys by any means. Yellow brass may be any high zinc copper alloy of the right color. Brazing metal may be any high copper alloy that will stand the necessary heat. Gun metal may be any reddish colored alloy of moderate hardness and tenacity. German silver may be a nickel alloy and again it may not. Babbit metal may be any antifriction mixture that will meet the requirements of the machine and the purse of the customer.

It must not be inferred, however, that anything will do for the jobbing foundry mixture. Good castings require good metals; castings for high pressures, wearing qualities, strength and ornamental purposes cannot be satisfactorily made with poor or unsuitable alloys. The homogeneous mixtures of the metals is required when high pressures are to be resisted. Friction and strength call for density. These qualities can only be obtained by an experienced mixer and with good materials. The specialty foundryman may never have to change his mixture from one year to the other. The jobbing foundryman, on the other hand, is compelled to change every other day, to produce castings for various requirements. Therefore, a wider experience is necessary for the jobbing foundryman that will enable him to make almost any grade of metal needed for any class of work; and superior mixtures for general work from scrap metals. The subject of mixtures is too big to be dwelt with here and will be fully covered later. It should be taken for granted, however, that only a skilled man can control the mixing department of a jobbing brass foundry. Very often, the profit on a job depends entirely on the mixtures.

It is not an uncommon occurrence to have a sample of the metal broken from an old casting to be sent along with the order for new castings. To match this sample requires knowledge and skill, as well as experience. Of course, chemical analyses are out of the question in jobbing work.

Lack of Suitable Equipment.

The lack of suitable equipment in the average jobbing brass foundry has been the cause of much adverse criticism. There is no need of disguising the fact that these establishments are, as a rule, inadequately equipped. All equipments and all tools necessary for any ordinary or special job should be of simple design and as inexpensive as possible. In busy times the reign of the makeshift is supreme. There are hundreds of makeshifts peculiar to the jobbing foundry, and we will refer to one which will serve as an illustration as well as one hundred. Figs. 6 and 7 show the regular method of binding small flasks for vertical pouring, as well as one of the makeshifts for doing the same. The latter is certainly not attractive, but when a plant is crowded the practical features of this makeshift appeal to the average molder. When the metal is ready and there is a shortage of hand screws, anything that will hold the flask together is used. In Fig. 6, we have a half flask, a brick and two wooden wedges. This makeshift is frequently resorted to. This serves to illustrate one of the many emergencies constantly occurring in the jobbing brass foundry. That is why so many of the trade heroes graduate from this school. They are trained to circumvent what is almost impossible; to do without what they cannot get, and to regard obstacles as a part of the daily routine, and the difficulties spur them on to better work.

COPPER ALLOY EXPERIMENTS

BY C. VICKERS

THE following experiments were conducted in the foundry, under actual working conditions, the different proportions of metals being carefully weighed on ordinary foundry scales. The results, therefore, may be somewhat different from those which would be obtained in the laboratory and probably more interesting to the founder on that account, as he can easily duplicate any alloy that may strike his fancy.

In the first experiment, 35 pounds of copper were melted and to this were added 65 pounds of zinc previously melted separately. To this alloy one pound of aluminum was added. The result was a brilliant white metal, hard and very brittle, useless for foundry purposes, but possibly of value as a powder for producing decorative effects, where such things are used.

Experiment No. 2—Copper, 45 pounds; zinc, 55 pounds; aluminum, 1 pound. Still hard and brittle, but with a reddish fracture.

Experiment No. 3 — Copper, 4½ pounds; zinc, 5½ pounds; aluminum, ½ ounce. This was a beautiful golden yellow metal, stiff, rather hard, would bend almost double, with a crystalline fracture of a greenish color.

Experiment No. 4—Copper, 40 pounds; zinc, 60 pounds; aluminum, 4 ounces; phosphorus, 2 ounces. This was a metal externally bright yellow, but with a fracture like bronze, hard, dense and non-crystalline.

Experiment No. 5—Copper, 35 pounds; zinc, 65 pounds; aluminum, 8 ounces. This is practically the same as No. 2.

Experiment No. 6 — Copper, 3½ pounds; zinc, 6½ pounds; aluminum, 2½ ounces. A hard white metal with extremely brilliant fracture, may be easily powdered and very similar to No. 1.

Experiment No. 7 — Copper, 4½ pounds; zinc, 5½ pounds; aluminum, ¼ ounce. Rich yellow metal, files easily, but the alloy is not homogeneous in fracture. Similar, but inferior to No. 3.

Experiment No. 8—Copper, 5 pounds; zinc, 7½ pounds; aluminum, ½ ounce; tin, 1 ounce; silicon copper, ½ ounce. Metal with white, brittle fracture closely resembling Nos. 2 and 5.

Experiment No. 9 — Copper, 11 pounds; zinc, 9 pounds; aluminum, 2 ounces. This is the best alloy of all. Golden yellow externally, but red internally. Hard, sonorous, and of great strength. The greatest trouble in casting this alloy is its shrinkage. In casting where there are heavy parts, such as bosses, etc., a shrink hole will always be found at such points. This can be overcome by the use of a horn gate where permissible, gating on the heavy parts. It is a very fluid alloy and runs much better than any yellow or red brass alloy, and can be used for casting intricate figures, also for metal molds. It should be poured at a low temperature. By further experimenting with this alloy, I have succeeded in eliminating the shrinkage, so that it casts as well as ordinary red brass as regards shrinkage, and being fluid, runs much better.

This concludes the experiments with alloys of copper, zinc and aluminum. In all these the aluminum is necessary, as the alloy will not cast in sand without it.

BRASS CASTINGS FOR AUTOMOBILES

Discussion of the Alloys used for Special Motor Car Parts—Casting for Carburetor Body

BY E. F. LAKE

ORDINARY brass, that is, an alloy of copper and zinc in the proportion of about two parts copper to one of zinc, is used extensively in the construction of automobiles. Parts for which it is used include glands, nipples, bit cocks, valves, carburetor bodies and connections, levers, brackets, supports, valve caps, pumps, by-passes, strainers, etc. Many of these castings are made of special brasses by the addition of other alloys to give them certain required properties. Tin is used when increased strength is desired; lead to make them machine easily; aluminum to increase their tenacity, and antimony and phosphorous for other properties.

Tin.

While tin increases the strength of brass castings, it also makes them

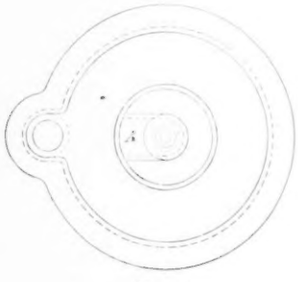


FIG. 1

more difficult to machine than ordinary brass, but owing to the strains and stresses to which an automobile and all its parts are subjected, not only in traveling over the road at a high rate of speed, but in an occasional effort at climbing a tree, tin is used to a large extent. Tin hardens the metal so much more rapidly than zinc that to obtain the same degree of hardness with zinc alone would require about ten times the amount of tin generally used, and this would make a brittle composition, as zinc increases the tensile strength when added to copper up to a percentage of 40, increasing it from 28,000 to 51,000 pounds per square inch, but beyond 40 per cent the tensile strength and ductility decreases, and with 60 per cent of zinc and 40 per cent of copper, the tensile strength is only 3,800 pounds per square inch and the metal is hard and brittle.

Use of Lead.

To make the castings machine more easily, lead is added in varying per-

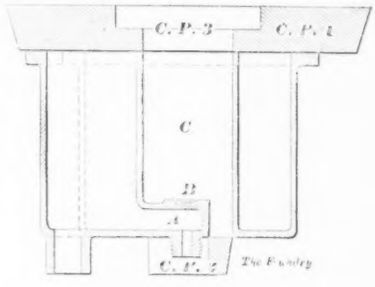


FIG. 2

centages. As this metal has a tendency to decrease the strength of the casting in proportion to the amount used, no more than two per cent should be added at any time, and its use should be abandoned entirely for all automobile castings with the exception of bearings.

Antimony has a tendency to produce a crystalline structure in which rupture occurs from the lowering of the adhesive force between the molecules. Antimony should not be used for motor car castings. Aluminum, when combined with phosphorus and properly added to copper, zinc and tin, makes a hard alloy and increases tensile strength. A closer grain is obtained, crystallization is modified and better castings and working qualities are secured. Unless properly handled in the mixing, a porous condition is liable to be produced in the metal. Some of the aluminum brasses are nearly as tough and as strong as steel.

Strength of Special Castings.

The strength of a few of these special castings is shown in Table I, which also contains the physical properties of rolled sheets, bars and forgings. In Table II are included a few of the combinations of alloys which are used for various parts of the automobile. Many more could be added, but these are sufficient to show the variations in percentage and the ingredients used in making the castings. Owing to the variety of the different parts and the work which they perform, different alloys are used on the same automobile. Sometimes as many as six alloys are used on the same car,

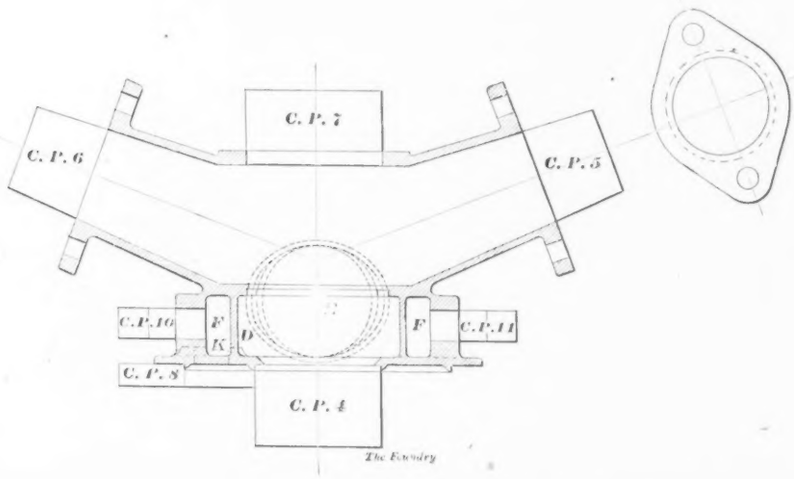


FIG. 3

and naturally the colors of the brasses vary to the same extent. In view of the fact that many of the brasses are exposed, the majority of them are plated a light yellow to make the color uniform.

Color Variations.

The different colors which are produced are shown in the following table:

Per cent of copper	Per cent of zinc.	Color.
95.0	5.0	Copper red
92.5	7.5	Reddish bronze
90.0	10.0	Golden bronze
87.5	12.5	Dark orange bronze
85.0	15.0	Medium orange bronze
82.5	17.5	Light.
80.0	20.0	Greenish yellow
75.0	25.0	Golden yellow
70.0	30.0	Dark yellow
65.0	35.0	Full yellow
60.0	40.0	Light yellow

Other alloys when added to brass may slightly effect these shades, but not to any great extent if the percentage of copper remains unchanged. No combinations of alloys are so susceptible to changes of color as those of copper and zinc, as they vary from dark red bronze to pink, gray and even white by combining them in varying percentages. Thus, 35 per cent of copper and 65 per cent of zinc will produce a white alloy, while lower percentages of copper and higher percentages of zinc will produce a gray.

Brass has been used to such a large extent for automobile trimmings that many purchasers are beginning to tire of the bright brass color, and blacking has been resorted to by some manufacturers, while a few are bluing their brasses. To blacken them, some have used paints and varnishes, but as these are liable to chip off and expose the bright brass, another method similar to plating has been employed with good results, and the coating will not chip off.

Black Coating for Brass.

To blacken the brasses, they are thoroughly cleaned of all grease and foreign substances, polished and then immersed for a short time in a solution of chloride of antimony. They are then dried over a spirit lamp and are finished by brushing with a black lead brush. Another method which has been used for blacking the inside of brass tubes for optical instruments, and which will give any shade desired from gray to black, consist of the application of a platinum bichloride mixture to the thoroughly cleaned surface with a camel hair brush until the desired depth of color is obtained. The formula for the mixture is as follows:

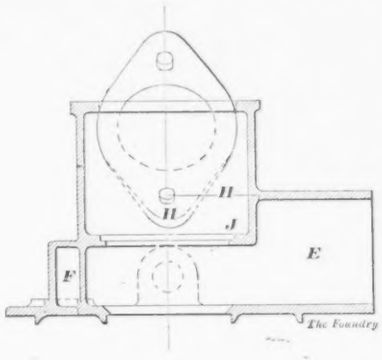


FIG. 4

Platinum bichloride, 4 drams.
Silver nitrate, 1 grain.
Water, 6 ounces.

This coating will, however, scratch off more easily than the one heretofore mentioned, and is, therefore, not as desirable.

Blue Coloring Solutions.

To give the brass a blue color, dissolve one ounce of antimony chloride in 20 ounces of water and add three ounces of pure hydrochloric acid. If these proportions are maintained, the solution may be made in any amount. When applying, the brass casting should be warmed and should be placed in the solution until it has turned blue. When removed, it should be washed in clean water and dried in saw dust. While these operations may seem to be within the province of the plater, they are presented herewith in view of the fact that no electrical apparatus is required, and as the operations are simple, they can be performed in any foundry which has appliances for polishing the castings. Ordinary brass castings should never be used for parts which are required to transmit power. Other sections, upon which there is no pressure nor strains are customarily made with the copper content as low as possible for reasons of economy, and the copper used occasionally runs as high as 60 per cent.

Special Brasses.

The special brasses, however, find quite an extensive use, and in some cases they have been used for engine or crank cases similar to the one described in the May issue of THE FOUNDRY under the title of "Aluminum Castings." The brasses for automobile castings should always be alloyed at as low a temperature as possible and afterwards remelted at a temperature sufficiently high to insure good castings.

Copper and tin alloys rarely give good results when melted only once, while copper and zinc are improved by remelting. Heat has a tendency to destroy cohesion, and for this reason a higher temperature than is necessary to properly mix the alloys, or to pour sound castings afterwards, is undesirable, as it lowers the tensile strength of most alloys and otherwise affects their mechanical properties. If the temperature is too high, the expansion is increased in proportion to the degree of heat within certain limits, and the greater the temperature, the more active are the gases which can permeate the metals more easily and interfere with the molecular arrangement and

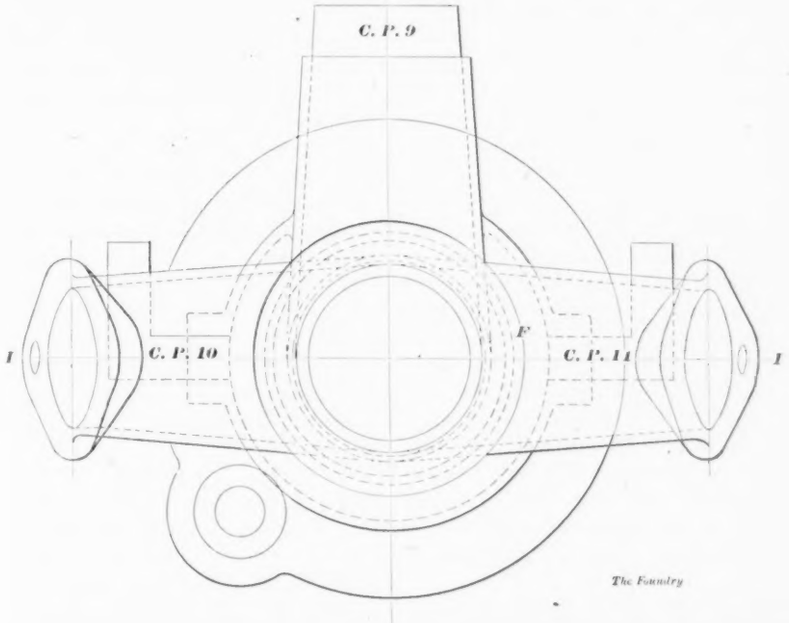


FIG. 5

retard the formation of homogeneous alloys by destroying the affinity of the particles for each other. Furthermore, a high temperature is detrimental to the metal, as that portion exposed will be melted and oxidized before the remainder of the charge has become liquid, and thus prevents the whole

Table I.

Kinds of brass	Tensile strength in pounds per square inch	Elastic Limit in pounds per square inch	Elongation percent in 2 inches
Sheet	70,000 to 102,000	30,000 to 95,000	10 to 35
Bars	63,000 to 102,000	25,000 to 95,000	5 to 40
Forgings	70,000 to 78,000	40,000 to 47,000	20 to 25
Castings	62,000 to 70,000	28,000 to 32,000	20 to 34

from forming into a homogeneous mass by the formation of numerous pores, which sometimes attain a size that cause the castings to leak.

Use of Scrap.

Scrap should never be used in making castings for automobiles, unless its composition is the same as that of the alloy used, owing to the fact that in designing a car, all sections have been made as light as possible to safely withstand the shocks and strains to which they will be subjected. If the content of the scrap is unknown, castings may be produced which are too weak, while on the other hand, if the composition is known and if it is free from iron, it is sometimes better than new metal. The remelting amalgamates its constituents, thus improving its uniformity and homogeneity. For melting brasses, one of the best known fluxes is common salt, as it removes the oxide of copper which is formed in melting by separating it into sodium and chlorine at a red heat. This allows the sodium to act as a reducing agent.

Table II.

Kind of Brass.	Copper.	Zinc.	Tin.	Phosphor-Tin.	Lead.	Aluminum.
Aluminum	84.0	12.0	2.0	1.0	—	1
Aluminum	90.0	6.0	1.5	0.5	—	2
Aluminum	92	3.0	8.0	0.2	—	4
Aluminum	90.0	1.5	0.3	0.2	—	8
Tough engine work	77.0	11.5	11.5	—	—	—
Glands, nipples, etc.	88.0	1.0	11.0	—	—	—
Castings to be brazed	94.4	2.8	—	—	2.8	—
Castings for malleability	72.0	18.0	4.0	—	—	—
U. S. Government naval	62.0	37.0	1.0	—	—	—
Yellow,	60.0	38.0	—	—	2.0	2 oz.
Yellow,	67.0	31.0	—	0.5	1.5	—
Yellow,	66.6	33.4	—	—	—	—
Red	85.0	10.0	3.0	—	2.0	—
Red	88.0	1.0	10.0	1.0	2.0	—
For casting to iron	83.0	—	8.5	—	8.5	—

Oxidation of Copper.

If the copper in melting is kept well covered with charcoal, more or less oxidation takes place, but if the copper is kept covered with salt, no oxide will be formed. All that is necessary is to throw a handful of salt into the crucible before melting begins when the metal is being put into the pot. Salt fuses at 300 degrees Cent., and as it is of a much lower specific gravity than copper, the salt will rise to the surface of the metals as rapidly as it is melted and reduce the oxide as fast as it is formed. Another handful of salt should be added after the metal is melted, as no bad effects follow from the use of too much salt, except that it attacks the crucible if too large an amount is used.

Casting For Carburetor Body.

One of the most difficult brass castings used on the automobile is shown in Figs. 1 and 2. This is the carburetor body and is cast in two sections as shown. It is one of the many designs on the market, and gives a good idea of the float feed carburetor body and some of the difficulties that are met with in molding them can readily be seen. That part of the body shown in Figs. 1 and 2 would be simple to mold and core out but for the gasoline passage shown at A, which is ⅜ x ⅝ inches in size. This opening permits the gasoline to flow into the needle valve located at B, which controls the amount that shall pass into the opening C and transformed into gas by passing through D, Fig. 3 and mixes with the air taken in at E and at Figs. 3 and 5.

An order for 600 of these carburetors were received and a number of different ways of molding attempted, but the one shown was found to give the best results. The pattern was made with an overhanging core print, CP. 1, and another print on the bottom, CP 2. The core was then made in two parts. The outer, or float chamber core, with the passage A was made in one box with the core print portion of the core made as shown by the shaded lines of CP 1. This was lowered into the mold, and then the center core was lowered through it into CP 2. This was held at the top by CP 3, which was shaped in the larger core and the mold was closed with a flat cope. The top of the carburetor body shown in Figs. 3, 4 and 5, was molded by splitting the pattern on the center line, H, Fig. 4, and making the main core in two parts, which were pasted together and located in core prints 4, 5, 6, 7 and 9.

The offset, as shown at J. Fig. 5, was made loose in the core box to the line HH, and by cutting it in the center, it was drawn out of the core from both sides after it was dumped. The hot water passage for heating the gas, shown at FF, required a separate core, which was passed over the main core and located in core prints 10 and 11. These prints were made angular to hold the cores upright and in their proper positions. The boss, K, being thicker than the flange, necessitated the use of core print 8, so that it could be removed from the mold. These castings were made from yellow brass, the walls having been 3-32 of an inch in thickness. The castings furthermore had to be sound, no leakage of water or gas having been permitted. This required fine work on the part of the molders and core makers, as well as the correct setting of the cores in order to produce castings that would be smooth and not overweight.

Ph. Bonvillain & E. Ronceray, Paris, manufacturers and importers of molding machines, are meeting with considerable success with the sale of their machines in this country. Their plant at 131-5 Race street, Philadelphia, is kept very busy demonstrating the practical operation of their machines and making pattern plates by the Universal system. A large number of orders booked from foundries in different lines of work includes the following. One A-5 machine for general work, taking in flasks 14 x 14 inches to 16 x 20 inches, also an A-3 and an R-3 machine for large sanitary work, with pump, accumulator and patent pattern plates; for another firm an A-3, an R-3 and an A-6 machine, with pump, accumulator, assembling machine, and two sets of pattern plate apparatus; an A-5 machine, pattern plate apparatus and a sand machine; an A-5 machine and pattern plate apparatus. The principal sizes of their machines, and other equipment for the Universal system, are now kept in stock at their Philadelphia plant, that prompt shipments may be made when required. The E. H. Mumford Co., Philadelphia, has recently been appointed exclusive American sales agent.

BRASS FOUNDRY DIFFICULTIES SOLVED

Brass Drum—Manganese Bronze for Propeller Wheels—Electrical Conductivity of Copper Castings

BY C. VICKERS

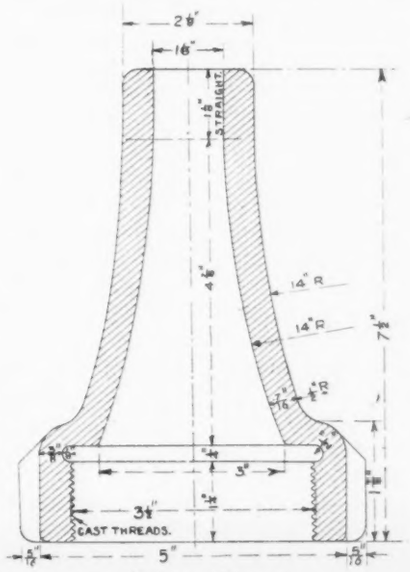
QUESTION.—I have an order for a 5-ton brass drum. It is 5 feet in diameter, 10 feet long, and the metal is about 1 inch thick. The outside surface is to be finished smooth. One of these drums has been made. Both the mold and core were bricked up in loam, and on account of the size of the casting we are obliged to melt the metal in the cupola. The formula used was as follows: Copper, 88; tin, 5; phosphor tin, 3; zinc, 2; lead, 2. The castings look good on the surface, but when machined we found a number of imperfections about the middle of the casting extending practically around its entire circumference. There was no dirt in these places, the metal being perfectly clean, but it appeared to have shrunk. In melting the metal, we put the copper into the cupola and the tin, lead and zinc were placed in a separate ladle and heated with charcoal. When about two tons of copper had been melted, it was poured over the tin, zinc and lead and melted in this way. This mixture was poured back in the ladle while the copper was coming down the cupola. This pouring was repeated and we feel confident the metal was thoroughly mixed in this way. Can you suggest any reason why this action took place, and tell us how it may be overcome?

Answer.—There are so many things which may be responsible for your trouble that to answer your question properly it would be necessary to see the casting made. The various steps in the production of the section could then be gone over and studied carefully until the causes of the difficulties were determined. As it is impossible, however, for us to see the casting made and the imperfections it contains, I will merely offer a few suggestions at random. If the holes have the appearance of being caused by shrinkage, no doubt the trouble could be overcome in the next casting by placing the feeders where they would do the most good. Massive bronze castings require a tremendous amount of feeding compared with iron castings of the same size. Let us know if this was one of the difficulties. I believe your metal was mixed properly, but it may have been cooled too much. Would suggest the use of more phosphor tin under these circumstances, for the reason that copper melted in a cupola is liable to be heavily oxidized as it comes into intimate contact with the fuel and the blast and thereby absorbs oxygen and other impurities from which it must be separated as much as possible after being tapped from the cupola. Furthermore, the cupola should not be run as hot as when melting iron. Reduce the blast so that the fuel will require it all and thereby less oxygen will be combined with the copper. Copper melted in the presence of free oxygen never makes solid bronze castings.

As some time has elapsed since this communication was received you may have overcome your difficulty and if so, it would be interesting to have your method explained in the columns of THE FOUNDRY.

BRONZE NOZZLES.

Question.—We are endeavoring to cast the nozzles shown in the accompanying illustration so that they will not have to be finished on the inside and that the surface may be perfectly smooth. We would like to know of a method by which the threads can be cast in the casting, also. We have been trying to chill the surface but have not secured very good results.



BRONZE NOZZLE

Answer.—I know of no process by which you can cast on the threads without using a chill. You will have to coat the chill and experiment to determine the best coating for your purpose. Plumbago, a water glass, shellac or linseed oil sprinkled with sand and baked, are all used with more or less success. The inside of the nozzle will have to be cored out and if the cores are made entire, from a complete and perfectly true core box and after baking are given a coat of any good plumbago core wash which is dried and polished, the result should be a smooth interior which needs no finishing for the purposes of a nozzle. It is my opinion, however, that you will secure better and more economical results, by coring out the entire casting and machining the threads. Bronze does not take kindly to a chill and there is always loss from blow holes, so that it is probable that by the time your experiments have taught you to cast the threads with success, you would have had the entire job finished if you had depended upon the old fashioned method of coring.

MANGANESE BRONZE FOR PROPELLER WHEELS.

Question.—We would like to secure a mixture of manganese bronze suitable for propeller wheels. We purchased some in ingot form, but it proved very unsatisfactory as it was like yellow brass when melted, and we found it to be very brittle.

Answer.—High tensile manganese bronze is a difficult metal to make in the brass foundry because of the high melting point of the wrought iron which is an important constituent. It is therefore best to purchase the ingots, and while your experience along this line has been an unfortunate one,

you are undoubtedly the victim of a fraud. While manganese bronze is yellow it certainly is not brittle. Would suggest that you consult the advertising pages of THE FOUNDRY and send for samples to some of the reputable firms contained therein. Manganese bronzes can be made by using manganese-copper, but it does not possess the strength of the manganese bronze containing iron. A fairly good alloy, yellow in color, is as follows: Copper, 50 pounds; zinc, 36 pounds; manganese copper, 4 pounds; aluminum, 4 ounces.

Red manganese bronze: Copper, 64 pounds; zinc, 5 pounds; tin, 6 pounds; manganese-copper, 4 pounds; silicon-copper, 1 pound.

ELECTRICAL CONDUCTIVITY OF COPPER CASTINGS.

Question.—I have recently made successfully some copper castings fairly plain and about 30 pounds in weight. They were machined all over and were without blemish. The question of conductivity arose, as they were for electrical purposes, and when tested gave only an average of 25 per cent. The materials used were of excellent quality, consisting of cuttings of hard drawn copper bars, each piece having an average weight of 1½ pounds. This was carefully melted, charcoal being used, and ten minutes before pouring two pounds of silicon-copper were added and the metal was well stirred. The silicon-copper contained about 20 per cent of silicon and the molds were dried. I would like to know whether the high content of silicon is the cause of conductivity, or what really causes the trouble.

Answer.—The correspondent has neglected to state the quantity of copper to which the two pounds of silicon copper were added. This amount of silicon-copper is sufficient to deoxidize 100 pounds of copper and produce solid castings from scrap material. Scrap copper requires a greater quantity of the deoxidizing element than ingot copper. This is due to the fact that scrap is oxidized more than new metal. We have obtained an electrical efficiency of 57 per cent from old copper wire deoxidized with 1½ per cent of silicon-copper. This was regarded as a very low efficiency and further experiments are pending to determine the cause of this phenomenon. There are several reasons which might account for the low electric efficiency of these castings, either the use of too large a quantity of the deoxidizing agent or the contamination of the copper by the iron absorbed from the furnace tools or foreign elements present in the scrap material of which the castings were made. A further reason may be charged to the presence of dirt or dross in the castings. This is one of the greatest difficulties encountered in the use of silicon or any other foreign deoxidizer of copper. This dirt does not show externally, but is beneath the skin like the holes in a sponge casting and has a very material effect in reducing the conductivity of the copper. To avoid this as much as possible, we run our copper castings from the bottom, using horn or any other suitable gates, the idea being to permit the metal to rise as gradually as possible through the mold, avoiding all agitation. At the highest point of the mold a large riser should be placed, sometimes on top of the casting. In this way we drive the dirt through the mold and into the riser. On large flat castings we incline the mold, geting it at the lower end, so that the metal must run up hill, the riser being at the highest end.

In order to secure high electrical conductivity the very highest grade of metal should be used. No scrap material can be expected to give good results, because it always carries too much oxide and furthermore, we have no idea how pure it was when new. The mere fact of its being rolled into bars and sheets, or drawn into wire, is no guaranty of its absolute purity. For this reason ingot copper of known purity should be used, melted under charcoal, and the smallest percentage possible of the deoxidizing agent should be employed. Less than one per cent of silicon-copper is sufficient for this purpose.

BRASS DRIVING BOXES.

Question.—I have had considerable trouble with the brass that I use for casting driving boxes for locomotives. I have been making them with the same kind of metal for seven or eight years, and have had no trouble until the last lot, which was prepared by the Ajax Metal Co., Philadelphia. The metal has a spongy appearance. I have tried charcoal and partially overcame the trouble by using ordinary brass in the mixture. Do you think that if the molds were cast on end that I could overcome the difficulty entirely?

Answer.—Casting these molds on end will not diminish the tendency to sponginess. The trouble lies with either the melting or the metal, and it appears from your statement that the metal might be at fault. Test this by carefully melting a small heat under charcoal and make some chunky castings that can be easily turned up. The first cut will show pin holes if the metal is to blame. If it shows up solid then the melting is at fault. The fact that you have made these castings for seven or eight years without experiencing any difficulty is no guaranty that you will never have any. You state that you have tried charcoal, thereby conveying the impression that you have discontinued its use. This you cannot afford to do, as you should always use charcoal or its equivalent—small blocks of hard wood, when melting copper or its alloys. Charcoal for use as a cover cannot be expected to prevent porosity in castings when such a condition existed in the metal before melting. If the brass is sound, charcoal is a very important aid in maintaining it in this condition, as it excludes the air from the molten alloy and reduces the oxides as they form. Why not make your own bronze instead of purchasing ingot metals? A good formula for driving brasses is as follows: Copper, 82 pounds; tin, 12 pounds; zinc, 4 pounds; lead, 2 pounds.

TROLLEY CAR WHEEL BEARINGS.

Question.—Kindly give us a first class mixture for trolley car wheel bearings.

Answer.—For journal bearings use copper, 80 pounds; tin, 10 pounds; lead, 10 pounds; phosphorus, 4 inches. For axle brasses use copper, 80 pounds; tin, 8 pounds; lead, 4 pounds; phosphor-tin, 2 pounds.

COPPER PRODUCTION IN 1907.

Statistics gathered by the *Engineering and Mining Journal* show that the production of electrolytic copper in the United States during the first of the year was 532,060,000 pounds. The production of lake copper up to September 1 was placed at 156,000,000 pounds. At the same rate for the last four months of the year the total production of electrolytic copper would be 798,090,000 pounds, and of lake copper, 234,000,000 pounds, a total of 1,032,090,000 pounds, against 1,040,037,781 pounds last year.

OBERMAYER BULLETIN.

The July and August issue of the *Obermayer Bulletin* contains the second of a series of articles on "Rat-tailing," and C. R. McGohey points out "The Right Way to Run a Foundry."

METALS IN FOUNDRY PRACTICE

Questions from Practical Foundrymen are answered in this department by the following experts

CAST IRON	W. J. KEEP
MALLEABLE IRON	DR. RICHARD MOLDENKE
METALLURGY OF STEEL	J. B. NAU
STEEL CASTINGS	W. M. CARR

OTHER EXPERTS ALSO CONTRIBUTE — ADDRESS ALL INQUIRIES TO THE EDITOR

CAST IRON NOTES

BY W. J. KEEP

QUESTION.—We recently cast a bell, the bowl of which weighed 175 pounds, out of horse shoes and such scrap which we received from a blacksmith shop, with a small portion of steel, probably a pitchfork or two, mixed with it. It contained a very small amount of cast iron, not over three or four handfuls. We find that this made an excellent bell, which rings nicely and better than our regular iron bells. What is your opinion in regard to the bell cracking and how would it be compared with bells made of clear white iron? What is the percentage of waste in blacksmith scrap? We mix steel car springs with our white iron with which we make the bell bowls. We have been throwing them in the cupola with the pig. What is your opinion relative to first raising these springs to an incandescent heat and after drawing a large ladle of white iron, mixing the molten car springs in the ladle? It seems to us that the two will almost immediately amalgamate. What is the best method?

Answer.—Place some pure aluminum in your ladle before running the iron into it, in the proportions of about one-half ounce for each 100 pounds of iron. You might try powdered ferro-manganese in the ladle without the aluminum, also with it. The aluminum will make solid castings and the ferro-manganese will remove sulphur. Horse shoes contain practically no carbon. Steel, such as pitchforks, would have about one per cent of carbon and white cast iron contains about 2½ per cent. The less carbon the more difficult it would be to melt the scrap. Aluminum will make it so fluid that gases can readily escape, thus leaving the casting solid. Be careful to melt just enough iron to fill the molds. Such iron should never be melted twice, as it absorbs sulphur. For the best results such scrap should be melted in an air furnace or in a crucible, so as not to be in contact with the coke. I would not expect that a bell made of blacksmith scrap would crack. It will be difficult for you to melt the white pig iron hot enough in a cupola that it will melt car springs in a ladle, but if you place the springs and aluminum in the ladle before the iron is tapped in they might melt, though the resulting iron would not be very hot and would have to be hurried to the molds. Placing the springs in the ladle if they would melt would be better than in the cupola, as it would decrease the sulphur. They would immediately mix with the white iron if there was sufficient heat to melt them. You might also try 50 per cent ferro-silicon either with wrought scrap or white pig iron. We would like to know the results of your experiments.

CRACKING OF PULLEY ARMS.

Question.—We are having considerable trouble with the cracking of pulley arms. The pulleys we are making are 18 inches in diameter, have a 12-inch face, and 5-inch hub with a 2-inch core. The rim is ¾-inch thick. We are troubled with the arms cracking while the castings are cooling.

Answer.—The cause is due to the rapid cooling of the rim and it becomes rigid while the hub and arms are still fluid. When these become solid they shrink about ⅛-inch, while the rim can not shrink as much, and the result is one or more of the arms are pulled apart. The remedy is to use an iron somewhat higher than what you are using in silicon and which has a lower percentage of shrinkage. Remove the sand from the center of the mold as soon as the pulley is poured. This will cool the hub and arms and will allow the hub, arms and rim to shrink together.

ARRANGEMENT OF CUPOLAS.

Question.—We would like to have an opinion as to the best method of arranging a pair of furnaces to bring down the metal hot and in the shortest time possible and to arrange them for the use of a minimum amount of coke. We propose erecting a pair of furnaces, and being rather isolated from foundrymen we would like to receive an expression of opinion from those having a long and varied experience.

Answer.—The above question gives no data as to the size of the cupolas and character of the castings. The location of the plant is in Ireland and consequently the concern will probably erect two cupolas on solid foundations, the refuse after melting to be cleaned out through an opening in the front of the cupola, and will use them on alternate days to permit each to be cooled and repaired. The American type is, however, to be preferred. These cupolas are supported on cast iron legs and have the bottom plate hinged in two parts which meet in the center, and which are held shut by an iron prop set under the doors which rests on the foundry floor. When the bottom is to be dropped the prop is knocked out and all slag and unmelted metal is dropped on the floor and when cold the next morning is taken away. The cupola is then cool enough to be repaired and can be used again, so that only one cupola is required for melting every day. The object of placing American cupolas side by side is to use one for small heats and two when large castings are to be made. Otherwise, it is much better to locate them in different parts

of the foundry so that the iron will have to be carried as short a distance as possible. The blast pressure should be about 14 ounces. The coke on the bed should be sufficient to reach about 2 feet above the tuyeres. Use equal charges of iron throughout the heat, melting each with about one-tenth of its weight in coke. The smaller the cupola the higher the melting ratio. With careful charging, good blast, and good materials, the iron will certainly be hot. Would suggest that an American cupola be purchased.

FOAMING SLAG.

Question.—We are having trouble with one cupola which has a capacity of about three tons per hour. It is due to the slag foaming over the tuyeres when the heat is about half off. Can you tell us how to remedy this difficulty?

Answer.—The foaming of slag may be started by the rust from the surface of the scrap used, but it is caused more often by coke which has not been in the ovens or retort long enough to sufficiently drive off the volatile matter. With so small an increase in volatile matter that a chemical analysis can hardly distinguish it, the coke melts and is caught by the blast and is blown into a foam. The remedy is to use a coke that has been in the oven a sufficient length of time to thoroughly coke it. By increasing the quantity of coke on each charge foaming is often stopped.

BLOWING AROUND CHILLS.

Question.—Can you tell us the cause of blow holes in iron cast around an iron rod in a chill mold?

Answer.—It is caused by gas forming as the iron strikes the iron rod. Moisture or rust on the rod would form gas and the iron, freezing suddenly as it strikes the rod, catches the particles of gas before they can escape.

'ROUND THE FOUNDRY CIRCUIT

EVANSVILLE, Ind., Oct. 25.—Jerry and me left the effete east—whatever that is—'bout 10 days ago, and by persistent and systematic travelin' with our weather eye constantly peeled for the yard limit signs, we got a good start on our annual trek 'round the foundry circuit. Sure the vernal microbe got in his work as usual this year when fishin' was good and the call of the pcewee was more entrancin' than the cussin' of the boss, but Jerry proposed that we defer our jaunt until fall, when we were to hike for the south, where the winters are more genteel and besides it's the fashion. Our side door Pullman havin' been sidetracked in the suburbs of Cincinnati, and our rations bein' low, we burned up the pike for the Rhine. After drownin' a dozen sinkers in a bucket of coffee we decided to hunt up somethin' temporary for a little pin money. We finally got on in a novelty shop down on the banks of the Ohio, this being the only place that was runnin' full, and as toys was one of the specialties, the floors were worked over time to fill the Christmas orders.

* * *

After we satisfied ourselves that the firm was right, we made a deal with the czar of the shop who told us we would find our benches on the second floor of the annex. We groped our way 'round the foundry, which was practically without windows, and Stygian darkness was turned into dawn by torches not yet equipped with smoke consumers. Hunt as we would, we could not locate the annex until the cupola tender directed us to a stable-like, tumble-down shack across the alley. We found our way up to the second floor by climbing a plank incline that was trod by many high steppers before the gasoline wagons were so popular. We found that this floor was only a balcony and below us the bunch had a day's work well under way. Evidently we were fillin' in where the equines were dined in the good old days of yore, and as the air up there would not even pass the careful scrutiny of a pure food inspector, Jerry decided that two days of velvet was about all his tender blowers could stand.

* * *

After our floors were up we looked 'round for the iron. With no furnace in sight Jerry suggested that if it were Chicago the cupola would surely be located in the annex to the annex. Suddenly we saw the bunch trotting down the incline and we followed across the alley to the temple of darkness. We knew the blast was on, as the old fan was makin' a noise like the storm scene in The Tempest. After gropin' our way over several littered-up gangways, we discovered one of those ancient 36-inch pots that in its palmy days undoubtedly worked over time in some boiler room. The iron was already comin' down, and the bunch from our floor was lined up for action. After they got their iron they passed us at a 10-second gait, and when it came our turn, Jerry and me were good for the 100-yard sprint through the old shop, but we weakened goin' across the alley and Jerry stalled on the incline. I helped him pour his floor that afternoon and we concluded to cash in and bid the old dump a fond adieu. Say, the lockstep up the incline was somethin' fierce, and the regulars on the mezzanine floor of the annex had a gait that is sometimes acquired by doing too long service for the state. We were told that this place was known as the famous "floatin' foundry." I did not blame the men for floatin', but I could not understand this terse description of the shop until a beautiful ochre application that was spread over the walls to the depth of several inches, met my gaze. It was an alluvial deposit dating back many years, and most artistically applied by the ragin' Ohio. We then hit 'er up for this burg and we have no complaint to make about the service between here and Cincinnati. There was plenty of trains and few yards, and while our car was shunted about a little, we made the trip in comfort.

* * *

While Jerry was consultin' schedules, and the most direct routes to the south, I took a look in at one or two of the shops. In a jobbin' plant I saw a rig for making grate bars that had everything beat that I ever came across. A roll over machine was used and the molds were carried down the floor by an electric traveler hung from the lower girder of the overhead crane. Attached to this traveler were two hoists which not only were used for handling the molds, but also held the bull ladles in position when pouring off. The molds were gated at both ends and the ladles supported by the hoists were moved from mold to mold by the electric traveler. The output, I was told, was close to ten tons a day.

SETU WRIGHT.

CONVERTER VS. SMALL OPEN HEARTH

Discussion of the Advantages and Disadvantages of these two Processes for the Manufacture of Small Steel Castings

BY W. M. CARR

IN response to many inquiries as to which steel making unit is best adapted for the manufacture of steel castings, it is proposed to consider the relative values from a practical standpoint of the converter process and the open-hearth. Both have certain advantages and disadvantages, and each has its earnest advocates as well as its opponents. One is cheaper to install than the other, but the lesser cost is offset by the heavier operating expense, while the other, with a higher first cost, can be operated with a smaller outlay.

Factors to Be Considered.

Granting then, that the steel foundry venture is necessarily a money-making project, the steel producing unit permitting one to market general steel castings with the greatest possible margin between production cost and selling price should be the one primarily considered. The low cost of equipping on one hand may prove attractive, but the higher outlay on the other promises more certain results, less annoyance, and greater profits, factors of prime importance that should be considered in the erection of every plant.

This discussion will not take into account the advantages of the converter process for the manufacture of special or alloy steel castings, but will treat of general steel castings coming within the following range of composition:

	Per Cent.
Carbon	0.18 to 0.45
Silicon	0.25 to 0.35
Manganese	0.50 to 1.00
Sulphur	0.015 to 0.05
Phosphorus	0.015 to 0.05

Crucible Process.

It will remain debatable ground in regard to the production of special alloy castings not easily produced by open-hearth methods and going below or above the ranges given, whether the side-blown converter method will hold favor over crucible steel melting. By the latter, almost any range of composition required by the trade can be secured, and a diversified demand can be met with steel by this process as well as by the converter. The simplicity of crucible melting, and the low first cost of the plant as compared with the difficulties of the converter and its greater initial outlay, are points in favor of the crucible process for special work, and in cases of limited demand and intermittent tonnage.

Advantages of the Converter.

The advocates of the converter process base certain claims upon the possibility of producing small light castings. It is conceded that converter steel can be turned out hotter than open-hearth metal of similar composition, but is not granted that converter steel on account of its higher temperature is any better adapted for the pouring of small castings than open-hearth metal. Practical foundrymen know that if steel is poured too hot into molds the castings are liable to fail or crack because of excessive shrinkage strains. In addition, they will strip very rough, owing to the sand burning to them. Steel, as it leaves the converter, is too hot to pour for the reasons given, and must be held for a time to cool, or gates and sprues may be added in the ladle to reduce the temperature. This practice brings the normal casting temperatures of the converter process down to the same level as that of open-hearth steel, which will likewise fill out molds for shapes both light and thin.

Converter Losses.

It should not be forgotten that the high temperature of converter steel is produced at the expense of certain important and essential metalloids, the blowing or burning of which furnishes the required heat in the bath of metal treated. The burning or oxidizing of the metalloids always entails a heavy melting loss, high in comparison with the open-hearth process, and which may range from 12 to 30 per cent of the weight of the metal charged.

The statement that losses will average 25 per cent of the original charge in some cases where the converter practice is representative, can be safely made without exaggeration. Such losses are not only wasteful, but appalling. No advantage is gained by burning up costly pig iron at the rate of 12 to 30 per cent per heat, to secure steel which must be cooled before it can be cast into molds. Open-hearth metal will answer the same purpose and besides, can be produced with a lower melting loss and with cheaper grades of pig iron. It is therefore evident that the losses as shown are of sufficient importance to be taken into account before deciding which steel-making process should be adopted.

Small Castings.

The demand for castings having strength higher than can be secured in gray iron and classified as light work, ranging from a few ounces to 20 pounds per piece, can be readily met by malleable iron and crucible steel plants, so that for ordinary light work the converter will always be in competition with the other two processes mentioned. Malleable iron can be made at a much lower cost than converter metal, and in lean years and during periods of low prices malleable is bound to hold the field.

Again, if light pieces, stronger and tougher than malleable are in demand, forgings (for certain shapes) or castings from crucible, converter or open-hearth steel are specified. Owing to the limitations of the crucible method, and its lack of adaptability to heavy work it will not be considered.

Advantages of the Open-Hearth.

The writer has learned by actual experience that open-hearth metal has a sufficiently high temperature for all practical purposes, and to reach or maintain a normal casting temperature there is not the slightest need of burning the roof or brickwork of the furnace in order to get the metal sufficiently fluid. It is common practice in open-hearth plants to pour 50 to 100 molds from a 20-ton heat, and the

metal at the end of the heat is hot enough to fill out light molds, even pouring them at that stage with fins on the castings not over 1-16 of an inch thick. Many similar instances can be cited to prove that open-hearth metal is more economical for general light work.

The small side-blown converter was first worked out commercially in Sheffield in 1891, and a few years later it was introduced in the United States. In England there is a plentiful supply of pig iron particularly adapted for the converter process and the development of the open-hearth in that country has been retarded owing to the scarcity of basic stock and rich fuels. In other European countries, however, the small open-hearth has scored pronounced successes in competition with various converter methods.

Raw Material.

In this country an ample supply of raw material has been favorable to the adoption of the basic open-hearth process, and the growth of the output of basic steel castings in recent years has, therefore, been marked. On the other hand there is an increasing scarcity of iron, necessary for the converter method, in this country, and this opens a new field for the small open-hearth furnace of moderate tonnages. The installation of small open-hearths has already been undertaken, and the number of furnaces having capacities of about five tons per heat, will show a rapid increase in the immediate future. In Europe, furnaces having an output of less than five tons are in daily use.

The scarcity of iron for the converter, its recognized heavy melting losses, and its high operating cost, are pronounced economic factors that cannot fail to result in the development of methods that will lessen the cost of production. Why the small open-hearth furnace has not received the attention in America that it has in Europe is frequently asked. It is a fact that all open-hearth plants in this country have been engaged in turning out the greatest possible tonnages and have constantly sought castings best suited to their equipment. A shop fitted with furnaces having capacities of from 10 to 25 tons per heat will seek business in the form of the heaviest possible castings. Small work is always slighted for the large, and there is a possibility that these light castings will become lost in the sand of the molding floor in the desire to ship the larger pieces. For these reasons open-hearth foundries have always declined the lighter sections.

Small Furnaces.

To meet the demand for small castings the converter filled a useful mission, because in such a shop satisfactory provisions could be made to handle small work. However, with the development of the steel casting industry and the demonstrated value of small castings, consumers, principally the railroads, now demand small parts in steel which were formerly made of malleable or gray iron, and they require that these be delivered with the heavier cast steel sections. Many open-hearth shops take them as an accommodation to the trade, but they are considered an annoyance for the reasons just cited, and not that they cannot be made from open-hearth metal.

These conditions have in several instances led to the fitting up of a shop with one or two small open-hearth furnaces where the lighter work can be handled and kept entirely separate from the heavy. That such a department is feasible and can be made commercially successful will be shown later.

(To be continued.)

UNIFORM CONTRACT FOR CASTINGS

THE machine tool builders of Cincinnati have under consideration a plan for formulating a uniform contract for the purchase of castings. The plan does not contemplate the forming of a set of arbitrary conditions which are to be put in future contracts, but to put in some concrete form the basis for a contract which shall be mutually satisfactory to the foundries as well as the machine tool men.

Past experience of machine tool builders has awakened a desire to work out harmoniously with the foundries some set of rules which shall apply in the settling of some of the disputes that arise between these two interests over the furnishing of castings.

A preliminary meeting has been held and committees have been appointed to take up certain subjects which have been found to be difficult to settle in the past. It is expected that as soon as some understanding is reached, as to what the buyers of castings consider would be just and fair to them and to their foundries, a joint meeting will be called and both sides will enter into a discussion of the questions thus brought up.

The subjects to be taken up by the committees are as follows:

Shaving cores.

Sliding scale basis of buying based on changes in the pig iron market.

Gating of patterns.

Responsibility of upkeep of patterns.

Analysis of castings.

Time limit on return of castings and price at which credit should be given.

Liability of foundries for time put in on bad castings.

The first of these subjects relates to the increase in the weight of some castings by shaving the cores, thus increasing the thickness of some parts as in lathe beds. A certain thickness is figured on in making the patterns and the shaving of the cores increases the thickness of the casting, resulting in an increase in weight. The object hoped to be obtained in bringing up this question is to have the casting conform as truly as possible to the pattern and to have the foundry call attention to the fact of necessity to shave cores and to have new patterns made if they are found to be incorrect, thus obviating the necessity of increasing the weight of the machine.

The matter of sliding scale contracts based upon pig iron prices will receive considerable attention. Some buyers are of the opinion that a price basis should be fixed to run for three months' periods, instead of changes based on published quotations fluctuating each month with the pig iron market. The usual plan has been to buy castings on the basis of a certain price, based on an equivalent price for pig iron. The castings to be charged for at a figure five cents per hundred pounds higher than such fixed basis for every advance of one dollar per ton in pig iron, or five cents per hundred pounds lower for every decline in the pig iron market. It has been suggested that instead of making these price changes fluctuate at five cents per hundred for castings for every dollar change in pig iron, that the basis be changed to an adjustment on

two and one-half cents per hundred pounds for castings for every 50 cents per ton change in pig iron.

In this connection *The Iron Trade Review* submitted the following form as a suggestion for a paragraph in sliding scale contracts which has been favorably considered by some of the machine tool builders and some foundries.

Proposed form for paragraph in sliding scale contracts with foundries for castings based on pig iron quotations:

Castings to be billed, based on the quotations for spot delivery pig iron in accordance with quotations appearing in the first issue of the month of *The Iron Trade Review*, the following table of equivalent prices to be used in making invoices for castings.

When the average quotation for spot pig iron delivered Cincinnati is:	Casting per 100 pounds.
$12.00	$2.20
12.50	2.22½
13.00	2.25
13.50	2.27½
14.00	2.30
14.50	2.32½
15.00	2.35
15.50	2.37½
*16.00	2.40
16.50	2.42½
17.00	2.45
17.50	2.47½
18.00	2.50
18.50	2.52½
19.00	2.55
19.50	2.57½
20.00	2.60
20.50	2.62½
21.00	2.65
21.50	2.67½
22.00	2.70
22.50	2.72½
23.00	2.75
23.50	2.77½
24.00	2.80
24.50	2.82½
25.00	2.85
25.50	2.87½
26.00	2.90
26.50	2.92½
27.00	2.95
27.50	2.97½
28.00	3.00

*Basing price.

The average quotation for spot pig iron to be determined by averaging the range of spot prices, delivered Cincinnati, for southern No. 2 foundry thus: If the quotation should be $22.75 to $23.25 the average quotation would be,

$22.75
23.25

2)$46.00

$23.00—$2.75 for castings.

When the average quotation is between the half dollar and the even dollar, the next higher figure for castings to apply. Thus: If the average quotation should be $25.25, the castings to be billed at $2.87½, which is the equivalent for $25.50 pig iron. If the average quotation should be $25.75, the castings to be billed at $2.90, which is the equivalent for $26 pig iron.

The basing price herein suggested has no reference to what the basis should be, and is used only for demonstrating the proposition.

"Gating of patterns" contemplates a discussion of the matter of expense involved when gating is done.

The subject of upkeep of patterns and responsibility for abuse of same in the foundries is self-explanatory.

As to the time limit for the return of castings found to be defective, it is said that some contracts stipulate that such returned castings must be returned within 30 days. This is often impracticable as the user of the castings does not have occasion in many instances to begin work on them for two or three months after they have been delivered to the plant, and the defect is not discovered within the 30-day time limit. A question which has arisen between the foundry and the machine tool builders is the matter of credit on these returned castings. The market may have changed quite considerably by the time the casting is returned and the price at which credit is to be given becomes a matter of controversy.

NO DELAY IN SHIPMENTS.

The Syracuse plant of the H. E. Mills Mfg. Co., Syracuse, N. Y., manufacturer of foundry supply specialties, was recently destroyed by fire. The plant was fully insured and will be immediately rebuilt and will be ready for operation shortly after the first of the year. Shipments will, however, not be delayed, inasmuch as this concern is now operating plants at Cleveland and Milwaukee, where orders will be filled.

NEW STEEL CASTING PLANT.

The Ohio Steel Castings Co., Lima, O., began operating its new plant last month with a force of 120 men. It is expected that 500 will be employed by the first of the year, as almost the entire output is taken through contracts with the Lima Locomotive & Machine Co.

TRADE PUBLICATIONS.

TOBIN BRONZE.—The Ansonia Brass & Copper Co., 99 John street, New York. Thirty-four page booklet devoted to a description of Tobin bronze in the form of rolled plates, sheets and bars for forgings. The basis of this alloy is copper, and when rolled hot it is remarkable for its high elastic limit, tensile strength and uniform texture. Tables are given showing the ultimate tensile strength, elongation and elastic limit, and a large number of testimonials are included.

CARBANESE.—Midvale Mining & Mfg. Co., St. Louis. This 14-page pamphlet contains instructions for the use of Carbanese in the ladle or cupola for improving gray iron castings. This product is a strong desulphurizing and deoxidizing agent, is furnished in powdered or granular form, and is described as a mechanical alloy of manganese, silicon, carbon, etc.

OVERHEAD TRACKING.—Moyer Tramrail Co., Philadelphia. Thirty-six page catalog illustrates and describes the Moyer overhead tramrail system as installed in brass and iron foundries. The catalog is handsomely illustrated, and shows the methods of conveying the iron from the cupola to the molding floors, as well as methods of handling cores and other material required in foundry work.

THERMIT.—Goldschmidt Thermit Co., New York. Twelve-page pamphlet devoted to a description of this product and its applications in foundry practice. Another 18-page pamphlet issued by this company describes the production of pure metals free from carbon by the aluminothermic method.

SAND MIXERS AND CONVEYORS.—The Standard Sand & Machine Co., Cleveland, has issued a catalog, 124 pages, which describes and illustrates the full line of labor saving machinery for foundries, brick plants, etc., which it manufactures. Numerous styles of sand mixers and screens are shown, several being equipped with conveyors for distributing the sand throughout the foundry. Pig iron, coke and coal conveyors are also illustrated. A large number of tables have also been reproduced which should prove of value to every foundry engineer.

ELECTRIC MOTORS.—B. F. Sturtevant Co., Hyde Park, Mass. Bulletins 144 and 147, which describe respectively the eight-pole, bipolar and four-pole types of motors which this company manufactures.

FOUNDRY SUPPLIES.—Four page folder issued by the J. W. Paxson Co. describes the White Dog core flour manufactured by this concern, white C shore sand, and machine twisted hay rope for foundry use.

WAX WIRE.—Alfred Field & Co., 93 Chambers street, New York, are sending to the trade enclosure cards containing samples of wax wire for core vents. This product is made in sizes from No. 20 to No. 0000 Stubbs gage. The wire is a composite article, its chief ingredient being telluric wax. It is drawn upon a small thread, which leaves the vent practically unobstructed.

PORTABLE INDUSTRIAL RAILWAYS.—This is the subject of a 24 page catalog issued by the Arthur Koppel Co., Pittsburg. It describes portable industrial railway systems for use not only in plant construction work, but in manufacturing establishments as well.

METALLURGY OF THE CUPOLA.—The Columbus Iron & Steel Co., Columbus, O. manufacturer of foundry iron, has reproduced a contribution entitled "The Metallurgy of the Cupola," by H. E. Field, Pittsburg, from the *Transactions of the American Foundrymen's Association*. This paper treats of the subject of melting and should prove of value to every foundryman.

CLEANING EQUIPMENT.—The Central Iron Works, Quincy, Ill., manufacturer of exhaust tumbling mills, foundry appliances, dust arresters, water cinder mills, etc., has issued a handsomely illustrated 62-page catalog which describes and illustrates its complete line of cleaning room equipment. The Quincy improved core oven, which is designed to handle a large variety of cores, is also shown and a large number of testimonial letters have been reproduced.

FOUNDRY ASSOCIATIONS AND SOCIETIES

Meetings of the Pittsburg. Philadelphia and New England Branches—Machine Cast Pig Iron

THE annual meeting of the Pittsburg Foundrymen's Association was held at the Hotel Henry, Pittsburg, on Monday evening, Oct. 7. The features of the evening were the addresses and discussion brought about by the talks of James Scott of Isabella furnaces, Carnegie Steel Co., and C. W. Mason of the Midland Steel Co., on "Uniformity and Modern Ideas for Making Pig Iron." The annual election of officers resulted in the unanimous selection of H. E. Field of the Mackintosh-Hemphill Co., president; Elliot A. Kebler of Matthew Addy & Co., vice president; J. S. Seaman of Seaman-Sleeth & Co., treasurer, and F. H. Zimmers of Union Foundry & Machine Co., secretary. The retiring president, H. P. Spilker of the Sterritt-Thomas Foundry Co., made a graceful speech, complimenting the association and its officers for the support they had given him, and President Field in assuming the duties of president, in an address urged a larger attendance at meetings and an effort to increase membership, saying that no expense had been spared in securing able speakers on subjects of interest to the foundrymen, and that the association deserved the earnest support of everybody in the business.

The New England Foundrymen's Association, in a communication to the Pittsburg society, asked that the latter appoint a committee to investigate the shortages in shipments, and, if possible, suggest some redress for abuses which foundrymen and other consignees are constantly encountering in this direction. At the present time, pig iron and coke are sold on railroad weights and often, when they reach destination, are short. President Spilker appointed a committee consisting of H. E. Field, Benjamin Fuller and Samuel Sleeth to take action upon this request of the New England Association.

Mr. Mason's Address.

Your program committee has asked me to tell you something about machine cast pig iron, that is, the casting in chill molds of pig iron for use in malleable and gray iron foundries. My information is limited to the experience of the Midland Steel Co. obtained during the past year with this method of casting, our entire production being cast in chills. Our foundry and malleable pig iron has been marketed in this district. A little trouble was experienced in the beginning, in introducing this chilled foundry iron among some of our foundry friends, but today those who formerly criticised it, use it, and regard it as one of the reliable brands.

Machine cast pig iron commends itself to you principally because of two things; its uniformity and its freedom from sand. You have been told of the greater difficulty the furnace-man has today, than formerly, in producing a uniform grade of pig iron because of the iron ores being higher in silica and more variable and the coke being higher in sulphur.

Variation in Quality.

In the hearth of a blast furnace the molten iron, ready to be tapped, varies, both chemically and physically, one portion may be hotter, higher in silicon and lower in sulphur than another. When the furnace is casting in sand molds or pig beds, the molten iron runs down a long runner, fills first the pig bed farthest from the furnace, then turns into the next bed, and so on, till the cast is finished. If the iron varies as it comes from the furnace then each pig bed and each pig in the bed is apt to vary considerably, according to the way the furnace is running, from the other pig beds of the cast. Analyses of different pigs taken from the same cast show variations in silicon ranging from 2.00 to 3.00 per cent, and variations in sulphur from 0.03 to 0.065 per cent. I have seen a cast of iron where pigs from the upper beds, when cooled and broken, showed a beautiful No. 2 foundry fracture, while the fracture of the pigs from the lower beds was mottled. We all know of the variation in the operation of a blast furnace and as these operations vary so does the product.

Machine Cast Pig

When the furnace is casting its product by machine the iron runs from the furnace into ladles. These ladles have a capacity of about 30 tons. The first part of the cast is not run into one ladle and the balance of the cast into another, but both ladles receive a share of the cast from beginning to end. The ladle acts as a mixer and while the iron coming from the furnace is variable, it is made uniform by thorough mixing in these large ladles. The contents of each ladle is poured into the chilled molds and the analysis of each pig in the different molds will vary but little from that of any of the other pigs cast out of the same ladle. The contents of one ladle is just about enough to make a fair carload.

The analysis of machine cast iron is much more dependable than that of sand cast iron. The usual way of making the latter is to take a sample from the beginning, from the middle and the end of the cast, mix the borings, and the chemist's determination of this mixture represents the analysis of the cast. The foundryman samples six to eight pigs from different parts of the car and the analysis of these borings represent his version of the chemical contents of the cast. Very often analyses of the furnace and consumer are different. The consumer's samples may come from the lower beds or the upper beds and the best the furnace can do is to give you its average analysis.

In analyzing machine cast pig iron determinations should be made of each ladle, and if only one ladle is placed in a car, the consumer's analysis of this car will check quite closely with the furnace analysis. The only difference should be in the manipulation and methods of the different chemists. The foundryman can rely upon analysis of machine cast iron as being truly representative, while the best he can expect from the sand cast iron is an average.

Machine cast iron is sold on the basis of 2,240 pounds to the ton, while sand cast is 2,268 pounds. This difference of 28 pounds is supposed to represent the amount of sand adhering to the sand cast pig. In some quarters complaint has been made that

this is not sufficient allowance. Take a pig of iron 18 inches long, 4 inches wide and 4 inches deep, allow two ends and three sides of this pig to be covered with sand to the depth of 1/16 of an inch and you will find the weight of the sand on a ton of these pigs to be between 26 and 30 pounds. You foundrymen know from your experience whether sand cast iron has attached to it more or less than 1/16 of an inch of sand.

Advantages of Sand Cast Iron.

The chief advantage, aside from uniformity, which sandless pig iron has, is that it will melt quicker in your cupola and with less coke, and at the end of the day's heat your cupola will be much cleaner. If you are melting 50 tons a day of sand cast iron you are putting into your cupola, according to a rough estimate, about 1,500 pounds of sand, also sufficient limestone to flux this sand, and sufficient coke to melt both the sand and the limestone. You gentlemen are much more familiar with this matter than I am, and know just what the saving in coke would be when you melt pig iron free from sand. Even if you are not cutting down your melting ratio, you certainly are getting hotter and cleaner iron from the cupola.

We have had reports from several foundries that our iron was running high in total carbon, and have also had reports of our low silicon iron making softer and more easily machined castings than the silicon content warranted. We have felt that this was probably due to the higher total carbon in the iron, the theory being that the iron in the molten state contained carbon above its saturation point, and that this carbon as soon as the iron meets the air begins to be thrown out of solution. As machine cast iron is cooled in chills more quickly, less carbon would escape than from sand cast iron which cools more slowly. This latter point I am not prepared to urge strongly but hope that later I can put some figures before you regarding it.

To sum up, briefly, machine cast iron is more uniform, its analysis more representative, it melts quicker and gives you hotter iron and a cleaner cupola with less cutting of the cupola lining than sand cast iron.

NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

The monthly meeting of the New England Foundrymen's Association, held in the rooms of the Exchange Club, Boston, Oct. 9, drew an attendance of nearly one hundred. After dinner had been served in the club banquet rooms, the business of the evening was disposed of, this consisting chiefly in the adoption of resolutions of regret at the recent deaths of D. B. Lincoln and A. F. Nichols, members of the organization. No report was made on the much discussed question of short weights, as the committee having this matter in charge has not yet completed its investigation; in fact, the problem has awakened such widespread interest and has developed so many varied lines of research that considerable time will probably elapse before a comprehensive report can be presented. The remainder of the evening was given over to a discussion of "The Universal System of Machine Molding." The subject was introduced by E. Ronceray, of Ph. Bonvillain & E. Ronceray, of Paris and Philadelphia, who have perfected the system in France. E. H. Mumford then described the workings of the system and the method of operating the French machines, lantern slides and moving cinematograph pictures serving to make clear the various steps in this process of machine molding. This discussion was practically identical with that recently given by the same gentlemen before the Philadelphia Foundrymen's Association, and the essential points of the universal system have been described in *The Iron Trade Review* and THE FOUNDRY. The address was listened to with keen interest and Messrs. Ronceray and Mumford were kept at the club until a late hour, answering questions of individual members. After the completion of the regular address, the gathering was entertained with a number of humorous cinematograph pictures. Mr. Mumford was elected a member of the organization.

SHORTAGES DISCUSSED.

The October meeting of the Philadelphia Foundrymen's Association, held on the evening of Oct. 2, was mainly devoted to social recreation, but considerable attention was given to a letter from the New England Foundrymen's Association regarding shortages in shipments of pig iron and coke. It was stated that the losses must be due either to mistakes in weighing at the point of shipment or to loss in transit. In order to ascertain which is the true cause it was suggested in the letters that a committee be appointed to co-operate with other foundrymen's associations in an effort to agree upon a uniform system of weighing. This suggestion was approved by the Philadelphia Association, and a committee will be appointed to take the matter up.

Birmingham Branch of the British Foundrymen's Association.

The autumn session of the Birmingham branch of the British Foundrymen's Association opened on September 21 with a smoking concert at the Acorn hotel, Birmingham. R. Buchanan, president of the branch, presided.

The president introduced the musical program with a few remarks in which he expressed the hope that the session would prove equally pleasant and profitable. Referring to the Sheffield conference he said they had a splendid time on that occasion, having been kindly received by everyone, especially by the managers of the works they visited.

The president concluded by reading the following draft of the arrangements for the coming season:

October 26, presidential address.

November 23, Prof. Turner, "Crystalization of Cast Iron."

December, G. Hailstone, (date and subject to named later).

January 25, A. H. Hiorns, "The Influence of Carbon in Iron."

February 29, Mr. Stocker, "Foundry Castings."

March 28, Mr. Fraser, "Notes on Contraction."

April 25, general meeting.

May 23, Mr. Parker, "The Testing of Alloys."

H. M. LANE INDICTED.

Henry M. Lane, formerly editor of THE FOUNDRY, has been indicted by the Cuyahoga county grand jury at Cleveland on the charge of grand larceny, but when arraigned before Judge Estep in criminal court was not ready to plead. Bail was furnished. Lane is indicted for stealing photographs and zinc, half tone and wax cuts valued at over $300, from the Penton Publishing Co., which are alleged to have been carried away shortly before his connection with that concern was terminated last January. This property was found in his possession in his office in the Schofield building, Cleveland, several months ago. It was seized pursuant to a suit of replevin entered in a justice's court, and is now in the hands of a constable.

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When sending articles be sure to place your name and address on the article and on the drawings.

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Flask Storage

The flask yard of a jobbing foundry is usually a sad sight, and that of a regular manufactory is often not much better. The unused becomes the misused, and good value is lost through improper care, and inconvenient storage. But in these days when order and cleanliness are becoming recognized as essential to a successful business, there is a strongly growing effort to keep things square among flasks as well as among patterns. The most satisfactory yards are built with straight lanes of good width, running at right angles to each other, and leading toward a central street from which entrance may be conveniently made to the foundry. The strongest evidence of false economy is to be found in the yards where nothing but a dirt roadway is provided the year round. The least that can be done to insure efficient trucking is to lay a board or plank runway, for which even second hand stock will serve a useful purpose. Best of all of course is a good industrial railway, or a smooth cement runway, the choice being dependent upon the type of service within the foundry. But the principal object of all is to provide a good top surface from which the snow may be easily shovelled in winter, and which is high enough above the level of the surrounding yard to prevent overflowing. The space between rails, and for some distance on either side, should in the case of the industrial railway, be filled in level with the top either with wood or cement. Of course with a railway system, turntables or switches are necessary. The latter are usually to be avoided as occupying an excess of room, and being less satisfactory than the former, which reduces to a minimum the space required for the turn, and can be made dirt and ice proof so far as working is concerned. Whatever the system, it should be so arranged that different groups of flask handlers will not have to lose time by waiting for others to work or pass. In a certain yard, which unfortunately is typical of many, the main runway, consisting of two planks — seldom parallel, rightly spaced, or fitted end-to-end—served as the outlet for barrow loads of ashes from the boilers, and dump from the foundry. Time and again, particularly during the winter season, one might find two or three men side-tracked in the mud with a big flask, while a single man with a barrow passed by. A proper system, with a suitable road-bed, would have been the means of saving many dollars otherwise worse than wasted. The jib crane, and the overhead traveler or gantry, has solved the dual problem of cheaply handling large flasks, and of economizing space in the yard. Instead of dumping these seldom used flasks at the end of various runways, as is all too common, the overhead method of handling makes it possible to keep them ship-shape and ready for use at all times. The provision of storage sheds or covers for small flasks is of especial advantage, and most easily arranged between parallel tracks, being supported from a central line of columns. These should extend sufficiently to pretty thoroughly protect from the weather, thereby preventing flasks from freezing, or becoming water-logged. While the flask yard may be the last end of the foundry to receive attention, the beneficial returns from careful management will not by any means be the least.

Trade Outlook

During the month of October all branches of the foundry trade began to feel the effects of the curtailment policy that has been adopted by many large consumers. The leading trunk lines have decided to defer purchases for future requirements and specifications on existing contracts are being held up temporarily. Agricultural implement makers, who customarily close during the early fall months with the malleable foundries for their season's requirements, are awaiting developments before placing their contracts, and while a round tonnage has already been taken by the malleable interests, the total is far below the aggregate under contract at this time last year. Steel foundries are likewise complaining on account of the dearth of tonnage and for the first time in several years their floors are running light. In the south one large cast iron pipe plant has been shut down and others will follow. In previous years the pipe makers have operated their works during the fall and winter months, accumulating stocks for the following season, but owing to the high cost of raw material and the declining pig iron market no large stocks will be amassed. Jobbing foundries are likewise operating below their normal capacities and prices have slightly declined. The continued refusal of railroads to place orders for equipment is largely attributed to uncertain financial conditions. Brass

foundries, especially the special shops operating on plumbers' supplies, report a decline in new orders and the working forces in many plants have been reduced. There is no decline in the demand for automobile castings, however, and the aluminum foundries are not only crowded for deliveries, but are unable to secure an adequate supply of raw material. Pig iron values continue to decline and in the south as low as $17 has been quoted for No. 2. In the Pittsburg district No. 2 foundry is held at $21.65, while at Chicago $22.50 is asked. In the east No. 2X is held at $19 furnace and basic is practically on the same basis.

A NEW FOUNDRY JOURNAL.

The first number of *Castings*, a journal of the art of founding, which will be published monthly by the Gardner Printing Co., Cleveland, appeared Oct. 15. The new publication is standard size and the first issue contains 78 pages. The reading matter is well selected, ably edited, and covers a wide range of subjects relating to foundry and pattern shop practice. *Castings* announces that it "stands for the cheerful co-operation that straightforwardly strives at the best in all things pertaining to the art of founding and will promote improved practice, act as a clearing house for the progressive, encourage research and in every way and all the time serve the needs and foster the technical interests of its readers."

PERSONAL.

D. B. Meachem, of Rogers, Brown & Co., Cincinnati, has returned from a European trip.

J. W. Lawler has been appointed superintendent of the iron foundry department of the St. Charles plant of the American Car & Foundry Co. Mr. Lawler is the oldest son of James G. Lawler, superintendent of the St. Charles Car Works, St. Charles, Mo., and was formerly superintendent of the foundry department of the Madison Car Works.

Frederick W. Sivyer, president of the Northwestern Malleable Iron Co. Milwaukee, has returned from his trip abroad. During his absence he toured through England and Scotland in an automobile.

M. H. Stimson has been made manager of the newly organized Vulcan Foundry Co., Grand Rapids, Mich. Mr. Stimson has been connected with the American Radiator Co., Detroit.

David Spence, formerly superintendent of the plant of the Greenlee Foundry Co., Chicago, has been placed in charge of the new foundry operated by Greenlee Bros. & Co., Rockford, Ill.

Benjamin McKenzie, who has been operating a foundry at Garrettsville, O., has been appointed foundry superintendent of the Trumbull Mfg. Co., Warren, O., to succeed R. H. Mills, who is now connected with the Columbiana Foundry Co., Columbiana, Ohio.

J. W. Dopp, who for several years has been in charge of the Chicago branch of the Tabor Manufacturing Co., Philadelphia, has resigned and has organized the J. W. Dopp Foundry & Mfg. Co., Des Plains, Ill.

A. W. Slocum, superintendent of the Dickson Car Wheel Co., Houston, Tex., has resigned and has returned to Pittsburg, his former home.

Walter B. Snow, for many years associated with the B. F. Sturtevant Co., announces his advent into the field of publicity engineering. He has established an office at 170 Summer street, Boston, and is prepared to undertake publicity work of any kind for manufacturers of machinery and allied products. Regular service will cover the conduct, on a salary basis, of the publicity departments of a limited number of non-competitive clients and special service will be rendered to others in the form of general advertising, catalog making, technical writing and investigations.

George Grove Blackwell, of the firm of George G. Blackwell, Sons & Co., Ltd., Liverpool, Eng., has received authority from the king of England to accept and wear the insignia of Officer of the Royal Order of the Redeemer conferred upon him by the king of Greece.

OBITUARY.

Thomas H. Williams, Jersey City, N. J., president of the A. A. Griffing Iron Co. and E. E. Williams & Son, brass foundry, died Oct. 19, aged 59 years. Deceased was widely known in the foundry trade in the east and was a member of the American Society of Mechanical Engineers, the Engineers' Club and the Lawyers' Club of New York, the American Geographical Society of Washington, and the Carteret Club of Jersey City.

F. W. Jerecke, president of the Finch Mfg. Co., Scranton, Pa., founder and machinist, died at a New York sanitarium, Sept. 28, at the age of 74 years, of which 40 years had been spent in Scranton. Mr. Jerecke was well known in the iron trade throughout his section and for many years was identified with the Dickson Locomotive Works.

COKE CHARACTER.

"Coke Character" is the title of a 12 page monograph published by Rogers, Brown & Co., Cincinnati. Coke quality is cleverly handled by the author, who signs himself "The Coke Man." A list of the various brands of coke for foundry, furnace and core oven purposes sold by Rogers, Brown & Co. is also included.

THIN CASTINGS.

A new method of making thin castings which cannot be cast in a mold in the ordinary way without chilling has recently been patented by George H. Brabrook, Taunton, Mass. The patent is based on the fact that phosphorus permits the metal to run very fluid, and when a thin section is to be cast the metal will not chill, but will fill the mold. The process is applicable to either sand or chill molds, and for such metals as bronze, etc., red phosphorus is used. For soft metals, yellow phosphorus is used. The mold is sprayed with an emulsion of red phosphorus and kerosene and the metal is poured in the usual manner. This process has been found particularly advantageous in the casting of ornamental work of all kinds.

Liquid chalk is very handy when laying out work on castings or sheet iron or steel. The best solution is two-thirds pint of very finely powdered chalk, one-third hot water and two tablespoonfuls of liquid glue, thoroughly mixed while hot. This can be applied with a brush, will not rub off with ordinary handling and provides a good surface on which to work.

The Northern Engineering Works, Detroit, reports the installation of Newton cupolas in the following plants: Oriental Metal Bed Co., Hoboken, N. J.; Berlin Machine Works, Beloit, Wis.; Miller Foundry & Specialty Co., North Tonawanda, N. Y. Northern electric cranes have been furnished the North Shore Electric Co., Waukegan, Ill., and Black Hills Traction Co., Spearfish, S. D. The Northern Engineering Works is adding a new power station to its plant. The boiler and coal storage station will be built immediately and will be approximately 30 x 60 feet in size. It will be equipped with a Wickes boiler, Murphy stoker and a Webster heater.

FOUNDRY & PATTERN SHOP EQUIPMENT

Speed Controller—Equalizer Beam—Cupola Charging Machine—Galvanized Iron Slip Boxes

AS GRINDING wheels wear down it is necessary to speed up the arbor in order to keep the wheels running at the right peripheral speed to do the greatest amount of work with the least wear to the wheel.

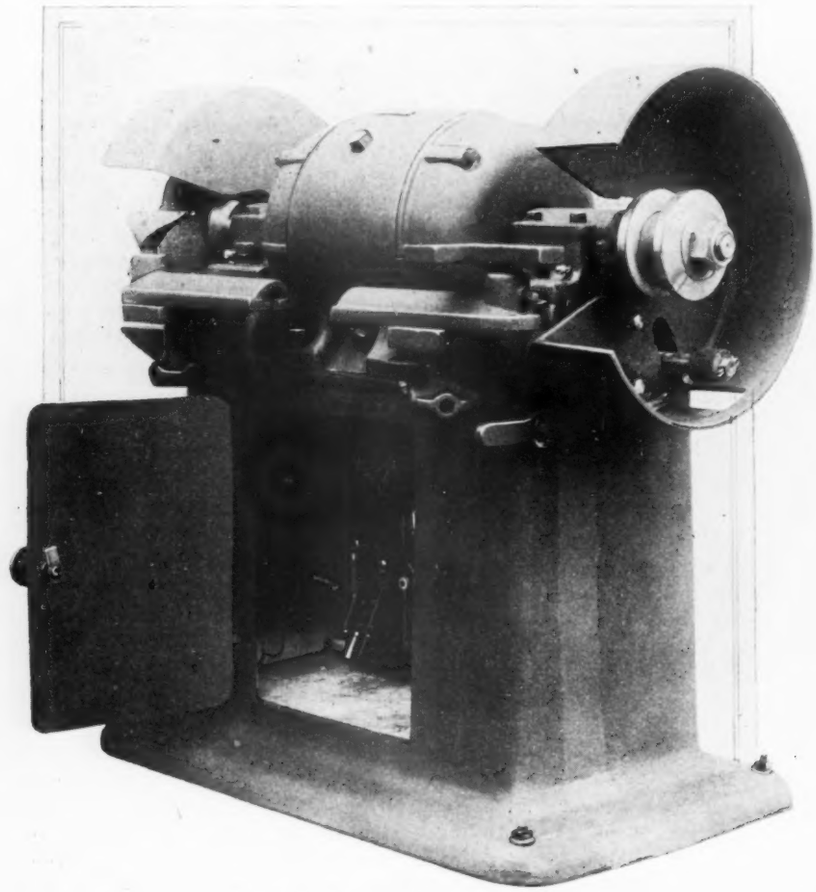
This has been accomplished in various ways such as the use of cone pulleys, variable speed motors, etc. These methods have been very unsatisfactory however, as very few operators will take the time to figure out the proper speed of operating an emery wheel. They merely increase the speed by guess with the result that the wheels are run too slow to do their work properly, or so fast they are liable to break, thus endangering life and destroying the wheel.

With the Ransom patent speed controller guess work is eliminated, and the operator knows that the grinding wheels are running at the proper speed to do the greatest amount of work a 75 per cent speed variation being obtained by means of external field control, and constant peripheral speed is maintained until the wheel is practically worn out. The speed of the grinding wheel is regulated by a gage or roller which is directly under the wheel and which is mounted on a transverse rocker shaft running the length of the machine. As the wheels wear down these rollers are set so that they touch, or nearly touch the wheels. The adjustment of these rollers is accomplished by means of an arm, which is connected to the traverse rocker shaft and comes forward, as shown in the illustration, and is in easy reach of the operator.

The adjustment of these rollers automatically moves the arm on a field rheostat in the base of the machine, thus cutting the resistance coils one after another in and out of the motor circuit, which in turn regulates the speed of the motor for that particular size grinding wheel.

If one wheel wears down faster than the other the speed is regulated by the larger of the two, as it is impossible to move the roller on one end only, thus preventing the machine being run too fast for the larger wheel.

This speed controller can be attached to any of the Ransom motor driven grinders for direct current, and is manufactured by the Ransom Mfg. Co., Oshkosh, Wis.



RANSOM PATENT SPEED CONTROLLER

A MOUNTAIN OF CORE SAND.

"Hoosier Slide," a miniature mountain of core sand located near the entrance to the harbor of Michigan City, Ind., is shown in the accompanying illustration. A long lease of this property has been secured by the Pinkston Sand Co., which has trackage facilities at Michigan City for 40 cars and can ship from 250 to 500 cars per month. The tracks are sheltered from the lake winds and are so free from snow drifts that shipments can be made throughout the winter. In 1860 this hill was 175 feet high, and at that time was covered with a growth of small white oaks which were later cut away. Denuded of the trees, the sand was left at the mercy of the winds, and was reduced in height at least 50 feet within 15 years. At times when its base was washed by the waves the sand would roll down in an avalanche and hence it was called "Hoosier Slide." Its length is about 2,000 feet.

A prominent geologist explains its formation as follows: "When a storm is in progress, or the wind is high, each succeeding wave brings up from the depths of the lake a small cargo of clean white sand and lands it on the beach. The storm abates, the waves recede and the wind takes this sand and carries it landward. The wind eddies about the roots and bushes which grow near by and piles up the sand at their roots. The sand continues to be piled up around the trees and bushes until after an extended period the sand hill is formed."

TABLE OF DIAMETERS OF CUPOLA BLAST PIPES FOR LENGTHS 20 TO 140 FEET, AND LOSSES OF ¼ AND ⅓ OUNCE PRESSURE PER SQUARE INCH.

The friction varies as the square of the velocity and inversely as the diameter of the pipe, therefore, if the diameter of the pipe is doubled the friction loss is divided by 32 provided, of course, the same volume is carried.

The advisability of using a large pipe for conveying the air is shown by the following table which gives the size of pipe which should be used for pressure losses not exceeding one-fourth and one-half ounce per square inch, for various lengths of pipe.

Diameter of Blast Pipes.

Tons of Iron per Hour	Dia. of Cupola inches. Inside	Ft. of Air per Minute Cubic	Length of Pipe in Feet. 20		40		60		80		100		120		140	
			Diameter of Pipe with Drop of													
			¼ oz	½ oz	¼ oz	½ oz	¼ oz.		½ oz	¼ oz	½ oz	¼ oz	½ oz	¼ oz	½ oz	¼ oz	½ oz	¼ oz
1	23	500	6	5	7	6	7		6	8	7	9	8	9	8	9	8	
2	27	1,000	8	7	9	8	10		9	11	9	11	10	12	11	12	11	
3	30	1,500	10	8	11	10	11		10	12	11	13	11	13	12	14	12	
4	32	2,000	11	9	12	11	13		12	14	12	15	13	15	14	16	14	
5	36	2,500	12	10	14	12	15		13	15	14	16	14	17	15	17	15	
6	39	3,000	13	11	15	13	16		14	17	15	18	15	18	16	18	16	
7	42	3,500	13	12	15	13	17		15	17	15	18	16	19	17	20	18	
8	45	4,000	15	12	16	15	18		15	18	16	19	17	20	18	21	18	
9	48	4,500	15	13	17	15	18		16	19	17	20	18	21	19	22	19	
10	54	5,000	15	13	18	15	19		17	20	18	21	18	22	19	23	20	
11	54	5,500	16	14	18	16	20		17	21	18	22	19	23	20	23	20	
12	60	6,000	17	14	19	17	20		17	21	19	22	20	23	21	24	21	
13	60	6,500	17	14	19	17	21		18	23	19	23	20	24	21	25	22	
14	60	7,000	18	15	20	18	22		19	23	20	24	21	25	22	26	23	
15	66	7,500	18	16	21	18	22		19	24	21	25	22	26	22	27	23	
16	66	8,000	18	16	22	18	23		20	24	22	26	22	26	23	27	24	
17	66	8,500	18	16	22	18	23		20	24	22	26	22	27	24	28	24	
18	72	9,000	18	17	22	18	24		21	25	22	27	23	27	24	28	25	
19	72	9,500	20	17	23	20	24		22	26	23	28	23	28	25	29	26	
20	72	10,000	20	18	23	20	25		22	27	23	28	24	29	25	30	26	
21	78	10,500	21	18	24	21	26		23	27	23	29	25	30	26	30	26	
22	78	11,000	21	18	24	21	27		23	28	24	29	26	30	27	31	27	
23	78	11,500	21	19	25	21	27		24	28	25	30	26	30	27	31	27	
24	84	12,000	22	19	25	22	28		24	28	25	31	26	31	27	32	28	
25	84	12,500	22	19	26	22	28		24	29	26	31	27	32	28	33	28	
26	84	13,000	22	19	26	22	28		24	29	26	31	27	32	28	33	28	
27	90	13,500	23	20	26	23	28		24	30	26	31	27	32	28	34	28	
28	90	14,000	23	20	27	23	29		25	30	27	32	28	33	29	34	29	
29	90	14,500	23	20	27	23	29		26	31	27	32	28	33	29	34	30	
30	90	15,000	24	21	27	24	29		26	31	27	32	28	34	30	35	30	

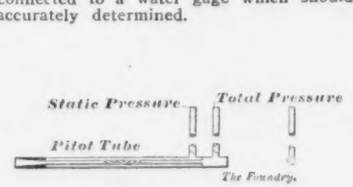
The minimum radius of each turn should be equal to the diameter of the pipe. For each turn thus made add three feet in length, when using this table. If the turns are of less radius, the length added should be increased proportionately.

*From Catalog No. 140, B. F. Sturtevant Co.

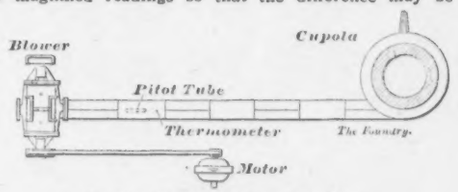
TESTING BLOWERS.

Measurement of Volume, Pressure and Horsepower at Pressure of One to Ten Pounds Per Square Inch.

Velocity.—The volume of air discharged from an orifice or pipe is, theoretically, equal to the product of the velocity of the air flowing and the area of the orifice. Hence, for the calculation of volume, the velocity is an important factor. To determine the velocity, the Pitot tube is commonly used as shown in the accompanying illustration. It should be inserted in the center of a straight run of blast pipe within about ten feet of the blower. One part of the Pitot tube transmits the total pressure, which is the sum of the static pressure and the velocity pressure. The other part, in communication with the slots shown by dotted lines, transmits the static pressure. Evidently the difference is the velocity pressure. Each is connected to a water gage which should show magnified readings so that the difference may be accurately determined.



Construction of Pitot Tube.



Location of Pitot Tube in Blast Pipe.

Accuracy.—Great care should be exercised in measuring the velocity pressure, and the instruments should be carefully calibrated. In the ordinary blast pipe for conducting air from the blower to the cupola or furnace, the velocity should not exceed two or three thousand feet per minute. As this velocity corresponds to a pressure of only about 0.4 inch of water, the measurement requires care, but with good instruments the readings will be accurate enough for all practical purposes.

Volume.—The velocity pressure being known, the volume of free air passing through the pipe may be determined from the following formula:

$$V = a\,v = \frac{60\,a\,c\,P_1}{P}\sqrt{\frac{2\,g\,p}{d}}$$

in which V = the volume of free air in cubic feet per minute,
c = coefficient of Pitot tube, which should be determined for each tube,
a = area of the pipe in square feet,
v = velocity in feet per minute,
$2g$ = 64.32,
p = velocity pressure in pounds per square foot; p is the difference between the two pressures observed on the Pitot tube.
d = density or weight per cubic foot of air at pressure, temperature and humidity at point of observation,
P_1 = absolute pressure of air in the pipe in pounds per square foot,
P = atmospheric pressure in pounds per square foot.

Horsepower.—Assuming that the air is compressed without cooling, the horsepower may be found from the following:

$$H.P. = \frac{V\,P\left[\left(\frac{P_1}{P}\right)^{\frac{1}{3.5}} - 1\right]}{11{,}000}$$

in which
V = the volume of free air in cubic feet per minute, as found above,
P = pressure of the atmosphere or suction pressure (absolute in pounds per square foot,
P_1 = pressure of compression (absolute) in pounds per square foot.

Formulas.—Including the preceding, there are four formulas sometimes used in computing the power required.

(1) $H.P. = \frac{V F l_c \left(\frac{P_1}{P}\right)}{33{,}000}$ (2) $H.P. = \frac{V P\left[\left(\frac{P_1}{P}\right)^{\frac{1}{3.5}} - 1\right]}{11{,}000}$ (3) $H.P. = \frac{V(P_1 - P)}{33{,}000}$ (4) $H.P. = \frac{\text{lbs. per sq. in.} \times V}{200}$

Formula No. 1 gives the horsepower required when the air is cooled during compression as in the ordinary air compressor.

Formula No. 2, which has been explained, is used when it may be assumed that the air is compressed so quickly that it does not have time to cool to atmospheric temperature as in nearly all blower work.

Formula No. 3, the ordinary "hydraulic" formula, is ordinarily used for pressures up to five ounces.

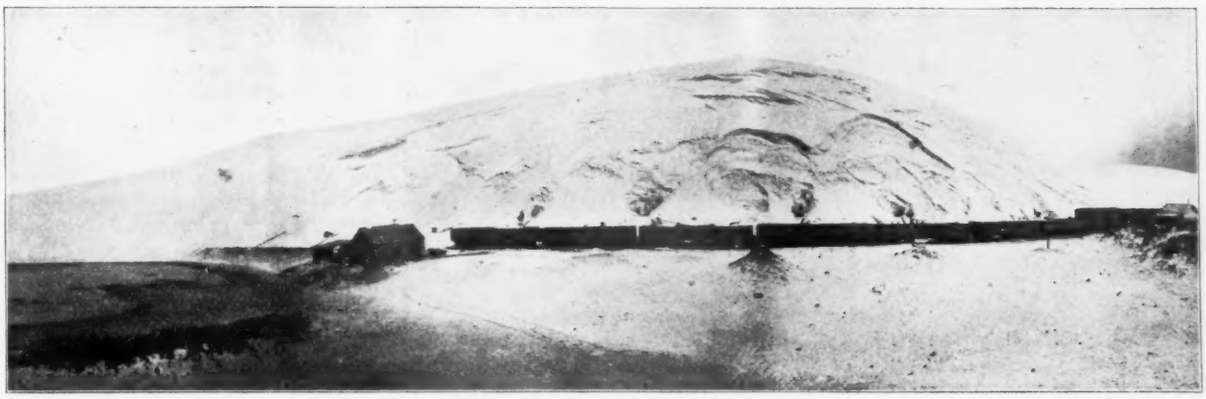
Formula No. 4 is frequently used for positive or rotary blowers, for determining the horsepower required for operating these machines. In this formula V = the volume of air displaced by the impellers, no allowance being made for slippage.

*From catalog No. 140, B. F. Sturtevant Co.

THE FOUNDRY DATA SHEET, NOVEMBER, 1907.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.



HILL OF CORE SAND AT MICHIGAN CITY, IND.

"Hoosier Slide" is estimated to contain about 4,000,000 tons of sand adapted to the making of cores.

Charles C. Kawin, chemist and metallurgist, has made the following analysis of a sample of the sand taken from the east pit of the Pinkston Sand Co.'s property.

	Per Cent.
Ignition loss	0.72
Silica	91.98
Oxide of Alumina	4.44
Iron Oxide	0.56
Lime	2.20
Magnesia	Trace
Loss or Undetermined	0.10

Regarding the properties of core sand, Mr. Kawin says that it should be as free as possible from any material which will form gas when the sand is brought in contact with hot iron. It should also be porous and at the same time should not be affected when it comes in contact with fluid iron. It should also possess the proper degree of fineness. After exhaustive tests made several years ago, he found that a satisfactory analysis of core sand should be approximately as follows: Silica, over 80 per cent; oxide of iron and alumina together, not over 10 per cent; carbonate of lime and magnesia, not over 5 per cent. The amount of organic matter should be very small, in fact, not over 2 per cent is desirable. This sand has been found especially well adapted for making cores for gasoline engines and other intricate castings. The sand is mixed in the proportions of 75 to 90 parts of sand to one of oil. As the sand is porous the oil sand cores require no vents. After the sand has been burned, in many plants it is crushed and is used with new sand in the proportions of 70 parts of old burned sand to 30 parts of new.

"Hoosier Slide" should not be confounded with the sand dunes scattered along the lower shore of Lake Michigan. The sand forming these dunes frequently contains roots and vegetable matter extremely undesirable in core sand. The sand is also being used extensively for making cores for steel foundry work and shipments are going forward regularly to the makers of radiators, car wheels, malleable fittings, steam pumps, etc.

EQUALIZER BEAM.

The usefulness of an equalizer beam can be readily appreciated by molders and foundrymen who have tried to make a satisfactory hitch on castings that were too heavy to be lifted by one crane. For such work the beam effects a considerable saving of time and insures absolute safety in that it equalizes and holds constant the strains on each crane. The Buffalo Foundry & Machine Co., Buffalo, has built the 100-ton equalizer beam shown in the accompanying illustration for use in its own foundry. It has given such satisfaction that its manufacture has been added to the company's line of specialties and will be furnished to the trade in all capacities. In its plant, the Buffalo Foundry & Machine Co. uses a 60-ton crane on one end of the beam and two 30-ton cranes on the other, the hitch to the piece to be lifted being made with wire cables passed through the single center lower clevise. The separating beam is of cast iron construction and is about 16 feet from center to center. The diagonal eye bars are made of hammered iron, the ends being forged solid and slotted to shape. The two upper ends and one lower center clevise are made of hammered open-hearth steel, forged and bent to shape.

The hanging center block and the swivel head are also made of hammered steel and are machined and finished from the solid. The entire strain on the swivel head is taken on a bronze collar having oil grooves connected with a compression grease cup. The pins are also forged and have forged hexagon nuts on the ends, with the exception of the lower center clevise pin, which has a head and an easily removable cotter pin,

EQUALIZER BEAM

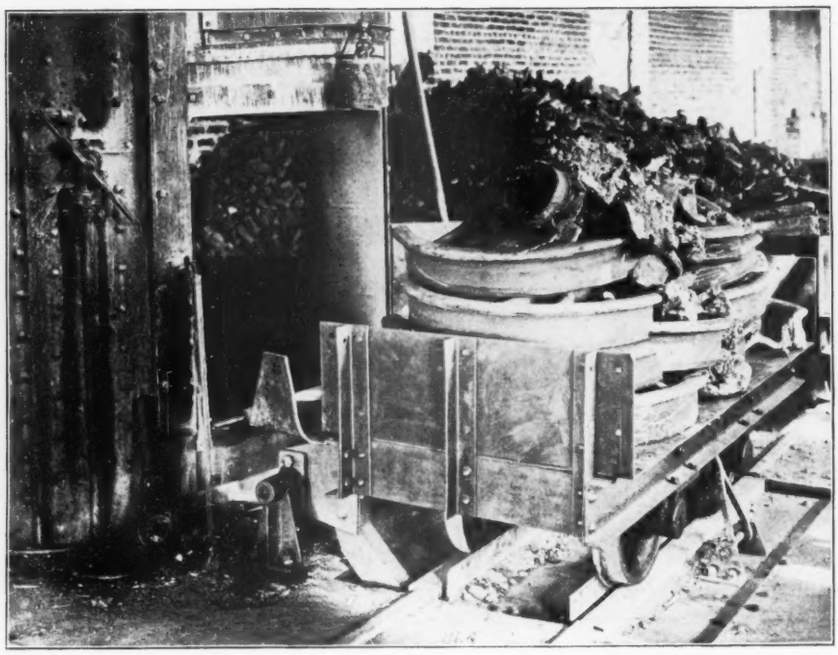


FIG. 1—CAR IN POSITION ON PLATFORM OF CUPOLA CHARGING MACHINE

that it may be detached and the fastening of cable or chain put in place and then connected to the beam so that the lift can be made. This does not necessitate the use of the cranes to support the entire beam while the fastening is being made. The total weight of the equalizer beam shown is 7,000 pounds.

CUPOLA CHARGING MACHINE.

Foundries melting continuously as well as those operating large cupolas are gradually discarding the slow hand method of charging their furnaces. On many floors, cranes have been installed to lift the boxes, while several plants have replaced the boxes with scoops, which are raised at one end and discharge their contents into the cupola.

A cupola charging machine, built by the Whiting Foundry Equipment Co., Harvey, Ill., and which has been installed in a number of car wheel foundries, is shown in Figs. 1 and 2. The charging cars are run onto the platform of the machine located in front of the charging door, as shown in Fig. 1. The car is fastened to the platform by a hook which engages an eye on the bottom of the side sill. The platform is tilted at an angle of about 40 degrees, by an air hoist controlled by a lever at the side of the furnace, and the car assumes the position shown in Fig. 2, a steel plate lip extending from the charging door prevents the falling of any of the material outside of the cupola.

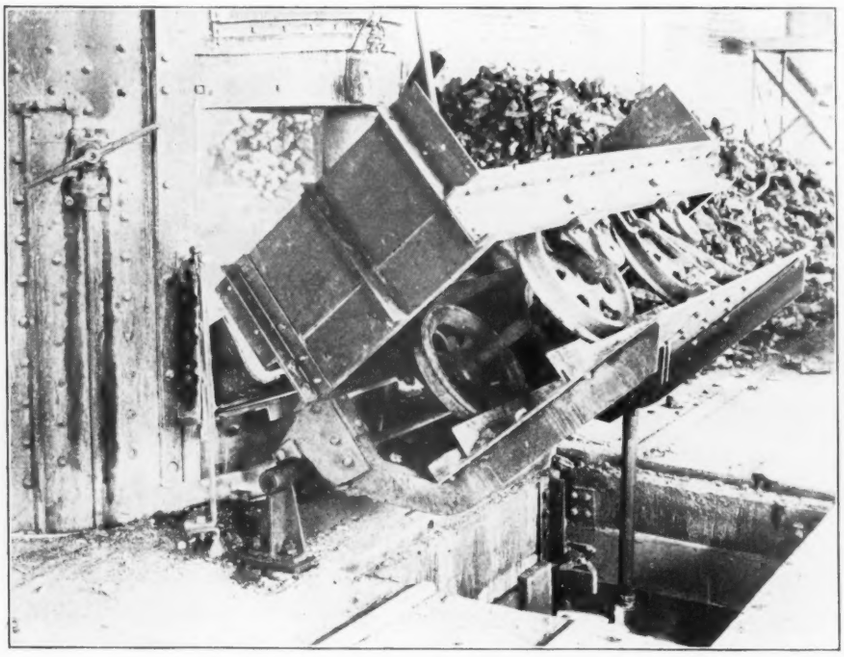


FIG. 2—CAR TILTED BY CHARGING MACHINE

The machine can be easily operated by two men. Installations have recently been made in the car wheel foundries of the American Car & Foundry Co., Madison, Ill.; Dickson Car Wheel Co., Houston, Tex., and the Canada Car Co., Montreal.

TRADE NOTES.

The Asbury Graphite Mills, Asbury, Warren county, N. J., have completed a number of improvements at their plant. These include a new office building of concrete construction, finished in hardwood and heated by steam, an electrical plant to furnish light for both mills and office, and the addition of new machinery in the mills, gives an increased capacity of about 25 per cent. There has also been added during the summer a large storage warehouse for crude graphite. These mills are owned by H. M. Riddle, importer, grinder and refiner of East India silver lead, Ceylon plumbago and flake graphite.

The Cincinnati Electrical Tool Co., Cincinnati, has established a western office and warehouse for the sale of its tools at Eighteenth and Rockwell streets, Chicago. Oscar P. Wodack, who has had a wide experience in the sale of electrical goods, has been appointed manager.

The Bristol Co., Waterbury, Conn., manufacturer of recording instruments, will erect an addition to its plant, 53 x 170 feet, and three stories in height. The increased demand for the company's recording instruments has made this addition necessary.

The Cutler-Hammer Mfg. Co., Milwaukee, has purchased the plant of the Wirt Electric Co., Philadelphia, and has consolidated the same with the company's New York plant at Park avenue and 130th street, where the manufacture of Wirt apparatus will be continued.

The Jamison Coal & Coke Co. is adding 100 new coke ovens and a 1,800-ton coal washer and steel tipple to its No. 1 plant at Luxor, Westmoreland county, Pa. This will make a total of 410 ovens at this plant. The company now owns 1,200 ovens in the Greensburg basin and produces

monthly about 20,000 tons of foundry coke and 40,000 tons of furnace coke. This is considered fully as high in quality as that produced in the Connellsville region.

The Boreas Mfg. Co., Piqua, O., has been organized to manufacture a patent bellows for foundries and other foundry specialties. J. H. Tecker, C. C. Jellef and G. F. Henry are interested.

The F. A. Austin Pattern Co., Syracuse, N. Y., has been chartered by Frank A. Austin, Allen C. Austin and Sarah Austin to design and manufacture patterns models and machinery.

A fine vein of molding sand has just been opened by the Mercer County Velvet Sand Co., near Greenville, Pa. The Bessemer Foundry Co., Grove City, Pa., will handle the sand for the trade.

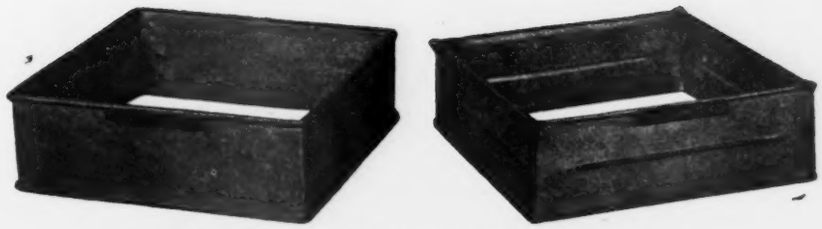
The Metallic Alloys Co., 99 John street, New York, has purchased the business of Kendall & Flick, Washington, D. C., miners of manganese ore and grinders of manganese ore, ferro-manganese, ferro-silicon, barium, etc. The mines and works of Kendall & Flick are located at Elkton, Va.

The Griffith Molding Machine Co., Beloit, Wis., will locate its plant and offices in Rockford, Ill. While the company has purchased all equipment for present requirements, it desires catalogs and printed matter for future reference.

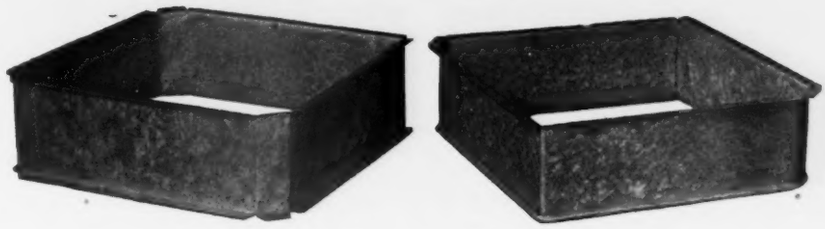
The Paige Retort & Crucible Co., Taunton, Mass., has been incorporated in Massachusetts to manufacture high grade crucibles and retorts. The incorporators are Edwin D. Paige, Willis K. Hodgman and Franklin D. Williams. The capital stock is $25,000. Mr. Paige, for whom the company is named, retired a few months ago from the Taunton Crucible Co., of which he was for 20 years manager and treasurer. The new company already has orders with which to begin business and will establish a plant in Taunton, for which special machinery has been built.

GALVANIZED IRON SLIP BOXES.

The galvanized iron slip boxes or jackets, made by the Diamond Clamp & Flask Co., Richmond, Ind., have been designed to replace the wooden and cast iron types generally used in foundries. Wooden boxes shrink and are frequently destroyed by run-outs while the cast iron box, frequently only ¼-inch thick, is easily broken.



FIGS. 1 AND 2—GALVANIZED IRON SLIP BOXES



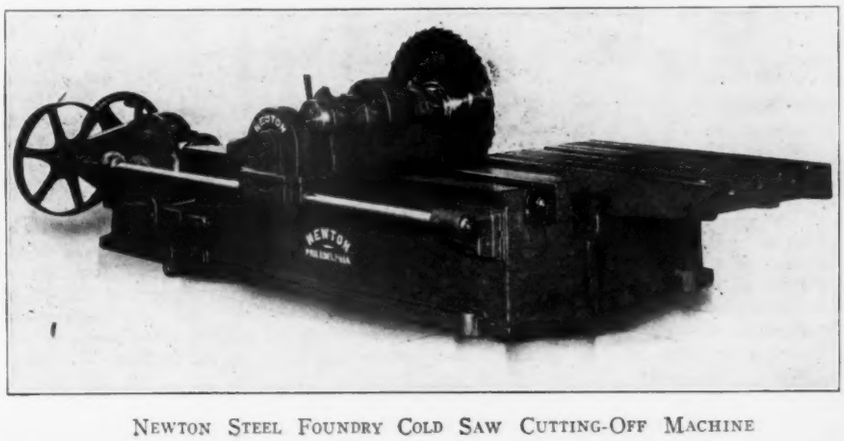
FIGS. 3 AND 4—GALVANIZED IRON SLIP BOXES

A square cornered, straight box, made of No. 22 gage galvanized iron, reinforced with No. 9 wire at the top and bottom, and provided with wooden handles, is shown in Fig. 1. A tapered box similar in construction to that shown in Fig. 1, but with ribs pressed in its sides is shown in Fig. 2.

A straight box with filleted corners and flanged on the top and bottom is shown in Fig. 3. A box, reinforced with a wire in the bottom and with a flange on top, having straight sides is shown in Fig. 4. The boxes are made in two depths, 4 and 6 inches, can be made to fit either straight or tapered flasks and are especially adapted for machine made molds.

A SPECIAL STEEL FOUNDRY COLD SAW CUTTING OFF MACHINE.

The Newton Machine Tool Works, Inc., Philadelphia, has recently brought out the special steel foundry cold saw cutting-off machine, which is illustrated herewith. A saw blade is carried of a diameter of 26 inches and having a capacity for gates or risers up to 7 inches in diameter. The saw blade used is of the Disston "premier" inserted tooth type, and is driven through countersunk head bolts, enabling the saw to cut off the gate flush with the side of the casting. The work table is 32 x 47 inches and has an in and out adjustment for convenience of operation. The casting is bolted directly to it. The saw spindle, 3⅞ inches in diameter, is driven through spur gearing by a phosphor-bronze worm wheel and a hardened steel worm of steep lead. Continuous variable automatic feed and a power quick return to the carriage are provided. The capacity of the machine is indicated by a report from a certain user that an average feed of ¾ inch per minute is obtained on all classes of castings which are cut on the machine. Some of these castings must be turned end for end, in order to make the cuts, as the gates are larger than the capacity of the machine. The carbon content of these castings runs as high as 0.65.



NEWTON STEEL FOUNDRY COLD SAW CUTTING-OFF MACHINE

GENERAL INDUSTRIAL NOTES

The plating plant operated by Haight & Co., Louisville, Ky., for more than 30 years, has been sold to John H. Cowles & Co.

The Western Foundry Co., 3650 South Kedzie avenue, Chicago, has increased its capacity about 25 per cent by the addition of a foundry, core building and fireproof pattern vault, which were recently completed and put in operation.

Every department of the new Malleable Castings Co., Columbus, O., is now in operation and about six tons of small castings are being turned out daily. The greater part of the output is taken by the Ralston Steel Car Co., Columbus.

The Nordberg Mfg. Co., Milwaukee, is progressing rapidly with the construction of its new cast iron foundry.

The Sphinx Foundry & Machine Co., Brooklyn, N. Y., has been formed by Thomas McElroy, 244 Gold street; Harry Hertzberg, 652 Forty-seventh street, and David H. McElroy, 12 Reid avenue, Brooklyn. The capital stock of the company is $100,000, and castings, machinery, etc., will be manufactured.

The J. W. Dopp Foundry & Mfg. Co. has been organized with a capital of $25,000, and will take over the foundry of the Geo. M. Garland Co., located at Des Plaines, Ill. This concern will make a specialty of light gray iron castings, and the plant will be equipped with the most modern machinery for doing this class of work. Operations will be commenced Nov. 1 under the general management of J. W. Dopp.

The Lorain Casting Co., Lorain, O., has practically completed its new foundry for gray iron and brass castings. It is a brick building, 110 x 130 feet, and will have a daily capacity of 50 tons. The officers are: E. M. Pierce, president and treasurer; R. Thew, vice president; F. A. Smythe, secretary, and H. B. Davidson, superintendent.

The Westchester Foundry Co., New Rochelle, N. Y., has been incorporated to conduct a foundry and manufacture tools, machinery, etc. The capital stock is $40,000. The incorporators are W. J. Jacobson, F. J. Holler, H. Benstem, of New Rochelle, and W. L. Morgan, New York.

The new steel casting plant of the Bonney-Floyd Co., Columbus, O., has been placed in operation and very satisfactory results are being obtained. The capacity of the plant is about 20 tons daily.

The Standard Foundry Co., Racine, Wis., has been formed with a capital of $15,000 by Knute Thompson, Albert Kousek, Henry Kousek and Richard Tilly.

The Manufacturers' Ornamental Iron Works Minneapolis, has been incorporated with a capital of $50,000 by E. P. Baker, H. L. Walton and E. A. Johnson.

The Youdelman-Walsh Foundry Co., Brooklyn, has been incorporated with a capital of $25,000 to do general foundry work. Those interested are: Hyman Youdelman, 786 St. Johns Place; Richard Walsh, 70 Norwood avenue; Max Lipkin, 841 Greene avenue, all of Brooklyn.

The new foundry building, pattern room, erecting and blacksmith departments that are being erected by the John F. Byers Machine Co., Ravenna, O., will be ready for operation in November.

The United States Radiator & Boiler Co., West Newton, Pa., whose plant was recently destroyed by fire, is now operating another foundry which had been idle for some time, and has not yet completed plans for rebuilding.

The Prime Steel Co., Milwaukee, which operates a foundry in the southern part of the city, has increased its capital stock from $15,000 to $50,000.

New Construction.

The Illinois Malleable Iron Co., 515 Diversey boulevard, Chicago, manufacturer of pipe and castings, will build a foundry at 1562 North Paulina street. It will be two stories, 241 x 270 feet, of brick and mill construction.

The Peck-Williamson Heating & Ventilating Co., Cincinnati manufacturer of furnaces, will erect a new plant at Oakley, suburb of Cincinnati. The following buildings, of brick construction and practically fireproof throughout, have been planned: Casting plant 70 x 140 feet; hand molding building, 70 x 100 feet; cleaning room, 70 x 80 feet; pattern shop, 80 x 160 feet; pattern storage house, 60 x 80 feet; warehouse, 70 x 300 feet; tin shop and molding department; 70 x 370 feet; office building, 40 x 50 feet and a detached power house,

The Allegheny Valley Malleable Iron Co., New Kensington, Pa., has practically completed its new plant which will be devoted to the production of all classes of malleable iron work. The company will soon begin the erection of another foundry building, 80 x 440 feet, which it expects to complete early in the spring. The total output of the plant will then be increased from 35 to 50 tons per day.

The Globe Malleable Iron Co., Syracuse, N. Y., has acquired five cars of land adjoining its present plant which will be used for future extensions. The company has within the past year constructed two additions, 80 x 160 feet and 20 x 160 feet, respectively, which have more than doubled its capacity. It is paying special attention to jobbing work in the east.

The American Steel Foundries has purchased ground for additions to its plant at Thirty-fifth and Smallman streets, Pittsburg.

The Columbiana Foundry Co., Columbiana, O., will build a new plant for the manufacture of gray iron castings under 10 tons in weight. R. H. Mills, formerly with the Trumbull Mfg. Co., Warren, O., will be superintendent.

The Superior Foundry Co., Cleveland, is completing additions which will increase its capacity from 80 to 120 tons per day. This increase will be chiefly in the piano frame department, where 450 piano frames per day will be turned out. The additions include a main building, 176 x 190 feet; finishing rooms, 56 x 280 feet, and 56 x 150 feet, and a storage vault, 25 x 65 feet. One new cupola will be installed.

The Chappell Furnace Co., Morenci, Mich., will remove to Huntington, Ind., where it will erect a new plant including a foundry and machine shop. A subscription of $20,000 by Huntington business men will increase its capital stock to $30,000. The company will change its name to the Majestic Furnace & Foundry Co.

The Contractors' Casting & Machine Co., Buffalo, is building an addition, 40 x 140 feet, to its present foundry building, which will make the finished structure 140 x 140 feet. Smaller buildings for pattern shop and stock room, cooling and chipping room and storehouse, are also being erected. The company will manufacture pile castings for the Pennsylvania tunnels under construction around New York, and expects to increase its output to 60 tons daily before December 1.

The Bucyrus Co., South Milwaukee, Wis., has decided to double the size of its steel casting plant, which now contains one 15-ton open hearth furnace, annealing furnaces, and other steel foundry equipment.

The Bass Foundry & Machine Co., Fort Wayne, Ind., is erecting a new car wheel foundry, which will increase its output of car wheels to 1,000 per day, and an extension to its car casting department. In addition to its Fort Wayne plant, this company operates a large foundry at Lenoir City, Tenn., for car wheels and general railroad castings, and a blast furnace at Rock Run, Ala.

The Byesville Foundry & Machine Co. has been organized to operate a foundry at Byesville, O. A foundry plant, including a main building, 110 x 200 feet, machine shop and power plant, will be erected.

The Columbiana Foundry Co., Columbiana, O., is erecting a foundry for jobbing work in light gray iron castings.

Brass Foundries.

The Adams & Westlake Co., Chicago, maker of car finishing fixtures and metal bedsteads, will erect a new building, 100 x 100 feet, seven stories high, of combination steel and mill construction. The present plant occupies an entire city block and two old buildings have been torn down to make room for the new one. A brass foundry will occupy the entire top floor, and the most modern devices for comfort and convenience will be incorporated in its construction. Steel curtains will divide the molding and pouring rooms. A saw tooth roof will insure ample light and a heavy concrete floor prevent damage from fire.

The Essex Brass Foundry Co., Amesbury, Mass., has been organized with a capital of $10,000 to do a general foundry business. John Miller is president and secretary and Charles W. Putnam, treasurer.

The United Brass Mfg. Co., Cleveland, is building an addition, 55 x 100 feet, to its foundry. Six new furnaces have been ordered.

The Rickersberg Brass Co., Cleveland, recently incorporated with a capital of $50,000 is erecting a plant on East Thirty-seventh street, which it expects to complete by Jan. 1. The company intends to have one of the most up-to-date plants in the country for the manufacture of plumbers' brass goods and brass specialties. A separate power plant will be erected, in which will be installed an engine of about 150 horsepower.

The Millett Brass Co., Springfield, Mass., has been organized by Eli Millett, inventor of the Millett core oven and head of the Millett Core Oven Co., Springfield. The foundry of the Knox Automobile Co., a building 50 x 183 feet, has been acquired and will be used for the manufacture of brass, aluminum, silver and composition castings. The new company will employ from 50 to 75 men and will have one of the largest jobbing foundries of its kind in New England.

CARBORUNDUM
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Carborundum Grinding Wheels

Cut faster---

Last longer---

Do more work in a day

And last more days before wearing out than any other grinding wheel ever made.

CARBORUNDUM

is the ideal abrasive---And there is a Carborundum grinding wheel for every possible need.

Let our experts find the one best suited to your requirements.

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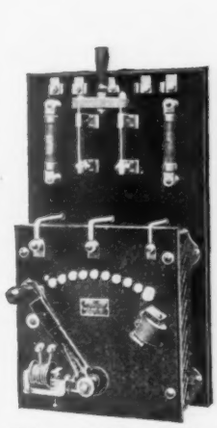
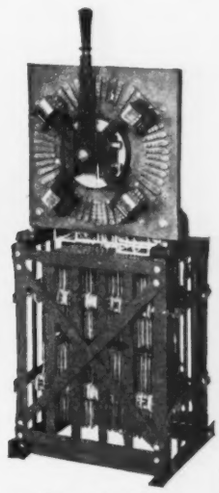
CUTLER HAMMER CONTROL

Electric Controlling Devices

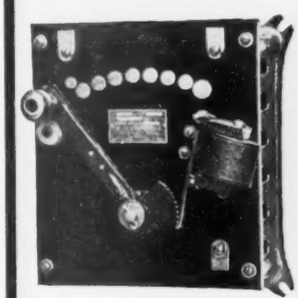
THE Superintendent of any plant in which electric motors are used will be interested in our Bulletins describing Electric Controlling Devices. We make more than 2500 types and sizes in all---counting standard apparatus only.



Universal Motor Starter complete with all protective devices---under-load and over-load release, knife-switch and fuses. (*Bulletin 21.*)



Crane Controller (*Bulletin 59.*)



Motor Speed Regulator (*Bulletin 40.*)

Machine Tool Controller (*Bulletin 78.*)

The Cutler-Hammer Mfg Co

MILWAUKEE WISCONSIN

Electric Controlling Devices for all purposes

NEW YORK OFFICE	136 Liberty Street
CHICAGO OFFICE	Monadnock Block
PITTSBURG OFFICE	Farmers' Bank Bldg
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CLASSIFIED ADVERTISEMENTS

Wanted and For Sale advertisements 40 cents a line. Positions and Help Wanted 25 cents a line. Count seven words to the line.

SUPERINTENDENT WANTED

A SUPERINTENDENT WANTED FOR A plant employing about 125 molders on gray iron castings. Must be thoroughly up-to-date in general foundry practice, including machine work, and able to handle men to the best advantage. An excellent opportunity with good salary to the right party. Address with references, giving past experience, Box 670, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTED

FOUNDRY FOREMAN WANTED, strictly high class. Must be well up in manufacture of gray iron castings in weights of from five pounds to ten thousand pounds each. Thoroughly familiar with molding machines and best application of patterns thereto. Well up in piece work system and modern foundry practice, capable of handling ninety to one hundred molders, coremakers, and laborers, and of producing at minimum cost. None but those possessed of experience and unquestionable references need apply. State salary expected. Address Box 669, THE FOUNDRY, Cleveland, O.

A FIRST CLASS FOUNDRY FOREMAN wanted to take charge of a modern foundry on the Pacific Coast. Must be a fearless, aggressive, and competent man, capable of handling all classes of engine work, and well up in molding machine practice. The foundry has a capacity of 25 tons and produces gray iron, chilled and semi-steel castings. Applications to be made in your own handwriting and accompanied by photograph if convenient. Willamette Iron & Steel Works, Portland, Oregon.

FOUNDRY FOREMAN OR SUPERINtendent wanted for iron works doing general jobbing and furnace work, must be capable and able to produce good results and come well recommended. To the right man would give opportunity to become interested in the business. State age, experience, reference and salary desired, and when engagement could be made. Address Box 639, THE FOUNDRY, Cleveland, Ohio.

FOREMAN WANTED FOR GRAY IRON foundry employing 75 molders on small soft castings situated within 10 miles of New York City. Must be sober and not over 40 years of age, must have knack of handling men and understand machine molding as well as Cupola practice. An excellent opportunity for the right man. Address Box 641, THE FOUNDRY, Cleveland, Ohio.

FOREMAN WANTED FOR A GRAY iron foundry making machine castings and general jobbing work up to five tons weight. Capacity of foundry fifteen tons per diem. Must be a good man on green sand and loam work. Open shop. Will make attractive salary to the right man. Address Box 666, THE FOUNDRY, Cleveland, O.

ASSISTANT FOUNDRY FOREMAN wanted for hollow ware foundry located near Pittsburg. Must have executive ability and be experienced in foundry details including molding machines. Open shop; no labor troubles. Give details. None but competent men need apply. Address Box 659, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN WANTED: WE run six molders and the line of work we are doing is plumbing supplies and general outside jobbing work. We have a good position for the right man. Must be sober and would prefer a married man. Address Box 651, THE FOUNDRY, Cleveland, O.

A YOUNG MAN WANTED AS ASSIStant foundry foreman. State age, experience and what lines of work you have been used to. Address Box 638, THE FOUNDRY, Cleveland, O.

FOREMAN WANTED FOR MALLEABLE iron foundry making saddlery hardware. Must have had experience on squeezer work. State age, experience, references and salary expected. Address 640, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN WANTED FOR small grey iron foundry in western New York. Permanent position in growing business. Address Power Specialty Co., 111 Broadway, New York City.

NON-UNION WORKING FOREMAN wanted for malleable iron foundry making small castings. Must understand mixing of irons and running cupola. Address Box 556, THE FOUNDRY, Cleveland, O.

CHEMIST WANTED

EXPERIENCED CHEMIST WANTED, competent to perform or to direct all of the analytical and laboratory work connected with a large foundry; probability that work will also comprise examinations and tests of other iron and steel products, fuel, etc. Location, Chicago. Position permanent. Give full particulars. Address Box 611, St. Louis, Mo.

CORE ROOM HELP WANTED

FORELADY WANTED FOR CORE room, foundry making light grey iron castings. State experience and give references. Address Box 664, THE FOUNDRY, Cleveland, O.

MOLDERS WANTED

AN EXPERIENCED MOLDER WANTed, familiar with cylinder work. Give full details of experience and wages. The Sheperd Engineering Co., Williamsport, Pa.

GRAY IRON FOUNDRY MOLDERS wanted. Highest wages paid. St. Louis Car Wheel Company, St. Louis, Mo.

PATTERNMAKER WANTED

PATTERNMAKER WANTED, EXPERIenced in sanitary work. Works located near Pittsburg. Address Box 618, THE FOUNDRY, Cleveland, O.

FIRST CLASS PATTERN MAKER wanted capable of making all kinds of job patterns. Must be high class, bright, clean and energetic. Address Box 649, THE FOUNDRY, Cleveland, O.

SALESMAN WANTED

SALESMAN WANTED VISITING FOUNdry and machine shop trade, to handle our goods as a side line. Vest pocket samples furnished. A very profitable proposition, requiring little time to demonstrate. Address Box 550, THE FOUNDRY, Cleveland, O.

HELP WANTED, MISCELLANEOUS

A PRACTICAL, ENERGETIC STOVE manufacturer wanted to take full charge of our manufacturing: one familiar with modern methods and a person of strict reliance. Would prefer investment of $25-$50,000, although we want the man rather than the investment. Address Box 631, THE FOUNDRY, Cleveland, Ohio.

PATTERN CLERK WANTED TO TAKE charge of a large number of patterns, large and small, in steel and malleable iron plant. Must be a man of method, experienced in handling patterns and a hustler. State age, married or single, experience and references. Address Box 667, THE FOUNDRY, Cleveland, O.

COMPETENT FOREMEN OF BRASS finishing room wanted for concerns in Pennsylvania and Massachusetts; must be experienced, aggressive men familiar with all up-to-date methods; salaries, $1,200-$1,800. Hapgoods, 305 Broadway, New York.

HIGH GRADE MAN WANTED WHO knows the manufacture of valves, air cocks, etc., from A to Z. Address Box 653, THE FOUNDRY, Cleveland, O.

FOREMAN WANTED FOR ANNEALING Department, ten ovens, malleable foundry. Address Box 646, THE FOUNDRY, Cleveland, Ohio.

FURNACE TENDER WANTED FOR malleable iron foundry making light saddlery hardware. State experience, references, etc. Address Box 643, THE FOUNDRY, Cleveland, Ohio.

SUPERINTENDENTS WANT POSITIONS

POSITION AS SUPERINTENDENT OR foreman wanted, in Foundry. Am 44 years of age, have had 20 years' experience in charge of Foundry producing high-grade heavy, medium and light castings with an output of 80 tons per day. Can introduce latest methods in green loam and dry sand. Well up in cupola practice and mixtures of metals. Will furnish references. Address Box 615, THE FOUNDRY, Cleveland, Ohio.

POSITION AS FOUNDRY SUPERINtendent wanted by a practical foundryman on heavy or light gray iron castings. Well experienced on molding machines. Would like to secure a position with a good reliable company where I can prove my ability. A No. 1 reference. Address Box 585, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS SUPERINtendent of a malleable or grey iron plant. Thirty years' practical experience. Thoroughly understands molding machines in every detail. Expert mixer and melter of metal. A thorough organizer. Can design, erect, equip and manage your plant. A-1 references. Address Box 662, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS SUPERINTENDent or general foreman in an up-to-date bench and machine foundry by a practical foundryman. Can handle a large force of men; am a good instructor, well up in cupola practice, make all mixtures by analysis. Am able to obtain maximum production with low percentage of loss, either malleable or grey iron. Open for engagement and will solicit correspondence. Address Box 645, THE FOUNDRY, Cleveland, Ohio.

SITUATION WANTED AS ASSISTANT superintendent in malleable or grey iron plant. Age 28, nine years' practical experience in mixing, melting and annealing. Good cost accountant, proficient in speeding help. Address Box 663, THE FOUNDRY, Cleveland, O.

FOREMANSHIP WANTED

FOUNDRYMAN WISHES TO CORREspond with some foundry company who has an opening for a foreman or superintendent. Am a practical foundryman up-to-date and a graduate from International Corresponding School of Mechanical Engineering of foundry work. Would take stock if suited. Address Box 602, THE FOUNDRY, Cleveland, Ohio.

POSITION WANTED BY FOUNDRY foreman, young, A-No. 1; experienced in fitting patterns to all types of molding machines, getting best production from same. Open shop preferred where molding machines are used partially or exclusively. Address Box 661, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WISHES TO make a change, shop making light and medium work preferred; up-to-date in foundry practice; energetic and no pipe dreamer. Good references. Address Box 636, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WOULD LIKE TO make a change. Well up in cupola practice, mixing iron, molding machines and modern methods. Address Box 579, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN IS OPEN FOR an engagement on stove plate, boilers or radiators; up-to-date in foundry practice. Good executive ability and best of references. Address Box 635, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY foreman, 18 years' experience; 6 years as foreman; best of references; gray iron foundry. Address Box 668, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY FIRST CLASS all-round foundry foreman, 41 years old; held present position 25 years; eight years' experience as foreman, 15 years in ornamental iron and bronze; good habits; first class in cupola practice and mixing of all metals. Address Box 660, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY A FIRST-class foundry manager or superintendent who understands the foundry business in all its details, having had charge of a light work shop on special lines of work, general jobbing foundries on light and heavy work, also heavy steam engine work. Can furnish A-1 references as to character and ability. Address Box 634, THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WISHES TO make a change. Correspondence solicited. First-class references. Address Box 671, THE FOUNDRY, Cleveland, O.

PATTERNSHOP HELP

POSITION WANTED AS SUPERINtendent of pattern shop or machine shop by one who was for 20 years superintendent of a large pattern shop. Recommended as being able to secure and hold men and get large results out of a low per capita pay roll. Address Box 657, THE FOUNDRY, Cleveland, O.

POSITIONS WANTED, MISCELLANEOUS

POSITION WANTED AS FOREMAN molder, eighteen years' experience handling men, heavy loam or dry sand and medium castings. Eight years' experience at molding machines. Good reference can be given. Address Box 626, THE FOUNDRY, Cleveland, Ohio.

POSITION WANTED AS FOREMAN Molder in malleable iron, brass or steel foundry by unmarried man; age 30; hustler, and can turn out work at minimum cost. Steady, sober and reliable. 12 years experience; best of references. Address 648, THE FOUNDRY, Cleveland, Ohio.

POSITION WANTED AS BOOKKEEPER or salesman by competent man. Several years' experience in foundry business; references. Address Box 637, THE FOUNDRY, Cleveland, O.

PROPERTY FOR SALE

FOUNDRY FOR SALE ON LIBERAL terms complete with Soil Pipe equipment, or the equipment separately, consisting of a full line of pipe and fitting patterns, from 2 to 8 in. both light and heavy; 19 pipe machines, and over 1,000 fittings and patterns, staple sizes, Match Plated with iron flasks, 25,000 sq. ft. of molding space. Capacity of cupola from 50 to 60 tons a day. Blower. Cupola, Machines and Patterns all new. Buildings all of concrete and brick. Would consider taking in an active partner or consolidating with an A No. 1 concern. Only legitimate offers from good parties considered. Located centrally to Buffalo, Cleveland and Pittsburg. Address Box 605, THE FOUNDRY, Cleveland, Ohio.

A COMPLETE AND FULLY EQUIPPED foundry and machine shop for sale in Southern California. Trade is well established and amounts from $3,000 to $5,000 per month. It is the only institution of its kind within a radius of forty miles and in the most prosperous and rapidly growing section of California. The business can be increased to almost any amount by the employment of the necessary capital. Owner desires to sell all or half interest on account of other interests demanding his attention. Riverside Foundry & Machine Works, Riverside, Cal.

AN A-1 FOUNDRY FOR SALE, ALmost new; doing $50,000 worth of business annually and capable of doing $100,000; will leave a contract with purchaser and retain an interest in foundry. Other business necessitates discontinuing active interest. Address Box 629, THE FOUNDRY, Cleveland, Ohio.

COMPLETELY EQUIPPED PLANT FOR sale, for manufacture of plumbers' brass goods. Well located for New York trade. Plenty cheap non-union labor. Ample ground for expansion. Will sell outright or retain part interest. Address Box 608, THE FOUNDRY, Cleveland, O.

FOUNDRY FOR SALE. ONLY ONE IN very progressive town. Great chance for man of limited means. Wm. Lambert, Read City, Mich.

MODERN EQUIPPED FOUNDRY FOR sale or lease, with privilege of purchase on easy terms; located in the most thriving manufacturing city in the middle west. Business good, territory the best. Please investigate this proposition. Address Bartlett & Reintges, Granite City, Ill.

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AMBITIOUS PROPRIETOR OF A thriving jobbing brass foundry in a large eastern city will consider partnership with a young energetic clever man thoroughly master of the technical end of a business related to the foundry. Technically educated man preferred. A prosperous future assured to the right man. Address Box 665, THE FOUNDRY, Cleveland, O.

COMPETENT AND AMBITIOUS MOLDER can secure exceptional opportunity to get into business for himself. Foundry is side issue and we will give rental first year and if results are satisfactory will give partnership. Address Box 647, THE FOUNDRY, Cleveland, Ohio.

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BLOWER BARGAINS.
Roots Second-Hand Blowers, bought, sold, or exchanged for new ones. Address,
H. M. PAPWORTH.
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ONE NO. 5½ ROOT CUPOLA BLOWER for sale, top discharge 17 inch. In use one week. Just as good as new. Sweet & Doyle Valve Co., Troy, N. Y.

ONE NO. 4 BAKER BLOWER, ONE NO. 4 B. Volume Blower and Countershaft for sale; nearly new. Buffalo Forge and Blower Co., makers. Will sell cheap. Address Oriskany Malleable Iron Co., Oriskany, N. Y. p.

TWO SECOND-HAND NO. 7 CHAMPION cupola blowers, for sale. Made by the Champion Blower & Forge Co., Lancaster, Pa. In good condition. Address The American Laundry Machinery Mfg. Co., Columbia, Pa. p.

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CRANE FOR SALE. LARGE HAND power wood post and jib crane, post 16 feet, jib 20 feet swing, very powerful hoisting and trolley racking rigging. For particulars and price inquire J. R. Johnson & Co., P. O. Box 515, Richmond, Va.

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TWO SECOND-HAND CUPOLAS IN first-class condition. Shells 72"-82" in diameter and about 40 feet high. Box 800, THE FOUNDRY, Cleveland, O.

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1 Mumford air squeezer, 44".
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Practically all new. Write for information to A. Buch's Sons Co., Elizabethtown, Pa.

FOUR ARCADE MOLDING MACHINES for sale at a sacrifice. Acme Steel & Malleable Iron Works, Buffalo, N. Y.

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CAST IRON TOY PATTERNS FOR sale, complete, up-to-date line, all gated and in excellent condition. Also few thousand dollars' worth of orders and sales included. Increase in other lines compels us to discontinue Toys. Address Box 548, THE FOUNDRY, Cleveland, O.

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One each No. 4, No. 5 and No. 5½ Baker Blower.
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Two Stationary and one Portable Millett Oven.
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SECOND-HAND FOUNDRY EQUIPMENT wanted, including Cupolas, Ladles, Tumbling Barrels, etc. Quote price and state condition. Address Box 885, THE FOUNDRY, Cleveland, Ohio.

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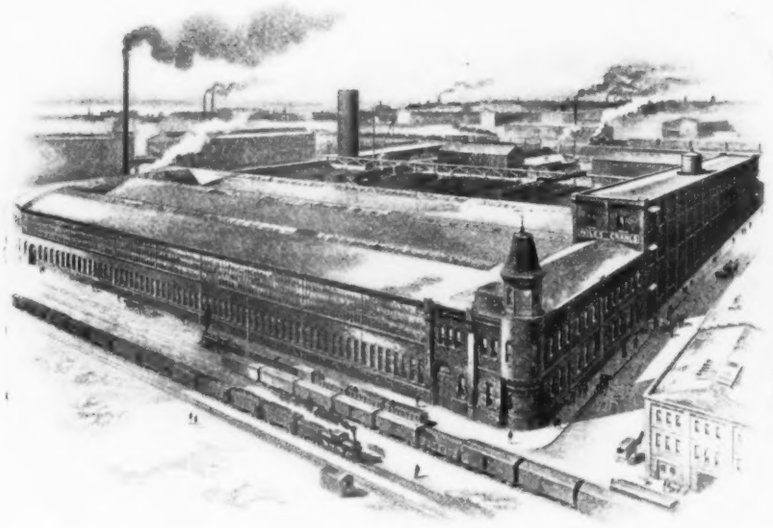

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Besides the cost of repairs, think of the cost of delays, then remember that

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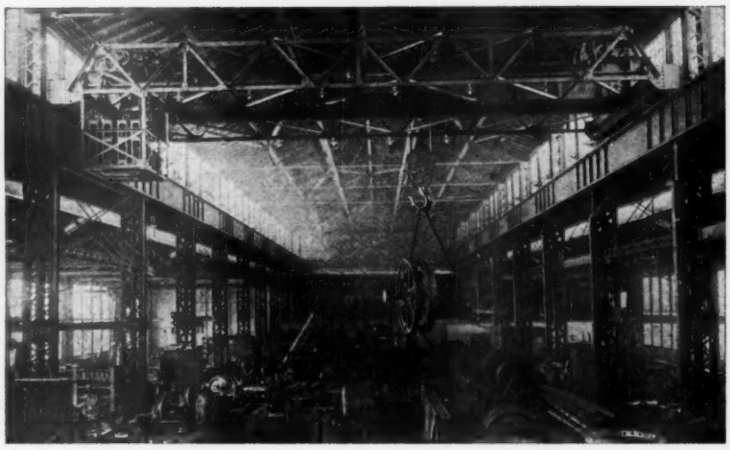
BROWNHOIST



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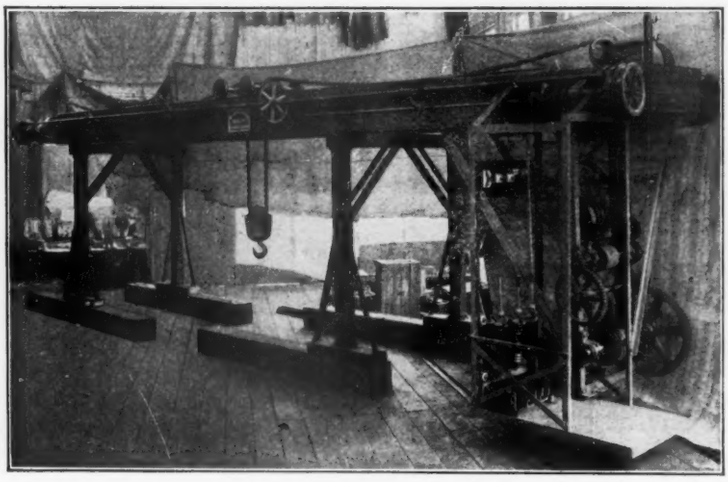

WHERE the head room is limited and the ladle of hot metal comes close up to the bridge, it is desirable to keep the hoist and motor away from the heat. In addition to the usual automatic electric and mechanical brakes the hoist is provided with a hand brake which gives absolute control of the lifting speed from full speed with a full load, to a few inches a minute for drawing patterns.

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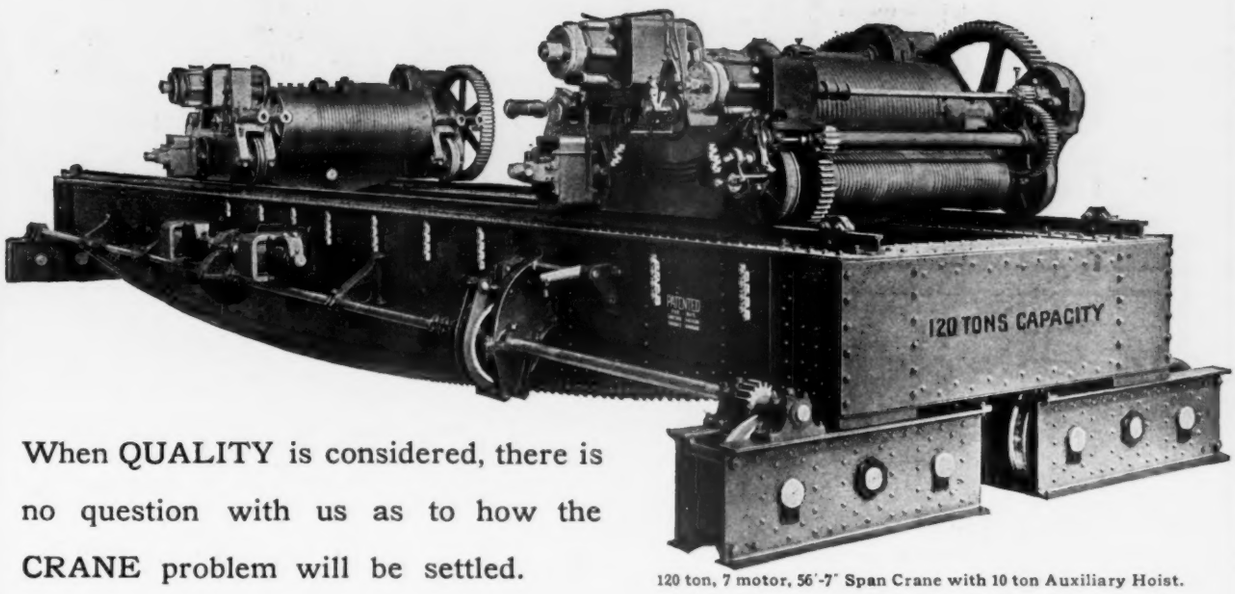

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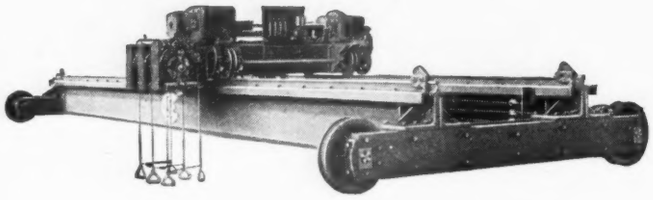

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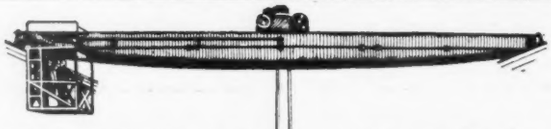

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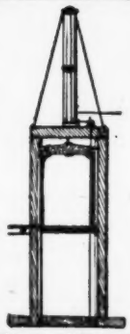

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Why the MOYER TRAMRAIL SYSTEM?

"Why not the ———— system or the rail made by ———— ?"

"Why should I purchase the MOYER system? Where are its advantages over the others made?"

Questions like these are asked every day in the year, so let's answer them now once and for all.

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Let's start with the rail. Just a standard section steel I-beam in good, straight, long lengths—no chance for dust to collect—and you know there is considerable dust in every foundry—the wheel surface is inclined, so whatever dust does settle on it, the trolley knocks off as it passes along.

The weakest point of every system is at the joint. Not in point of breaking, but in wear. That's why our rail lengths are twenty feet wherever possible.

Examine the joints—they are held securely in position by a splice plate, top and bottom. Eight good size bolts hold each plate—can't get away—can't get out of line. All rails are cold sawed exactly square both ways—that's why our joints fit so close.

We realize that the majority of our systems are erected by the customer's own men—that's why our entire lay out is so arranged as to be capable of any reasonable adjustment.

For example—we do not drill the rail for hangers, first it does not add any to its strength to punch holes in it—and, second, we seldom get measurements accurate enough to place holes. By means of our clamp hangers horizontal adjustment is made—the V-hangers give a vertical adjustment.

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All MOYER trolleys swivel so as to turn the curves easily—roller bearing wheels, with crown treads are used, to minimize friction wherever possible.

There's the whole answer as far as a brief description of the four main parts of the system will answer the question.

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Fifteen years, we've thought and planned and studied methods of improving the system. We've made mistakes and have corrected them, until we've the best system there is. We don't know how to make it better in any way.

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It has.

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We claim to be specialists at it—both in designing the lay out for your foundry—and in building the system after the lay out has been made.

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If you want to see a new booklet showing the system in detail, and better still some actual photographs of a number of installations simply say on your letter head———

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did not happen. They are an evolution—a product of changing conditions. The prime factors in the new hoist requirements are larger floors and heavier castings. Hence larger cores, molds, copes and more sand and metal must be handled. An increase in quality of output and a lower cost are at once elements that require more complete handling service—and its result.

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A Tramway System Equipped with TRIPLEX Chain Blocks.

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So says the Superintendent of Foundries and Pattern Shop Departments of the Bethlehem Steel Company about a Link-Belt installation.

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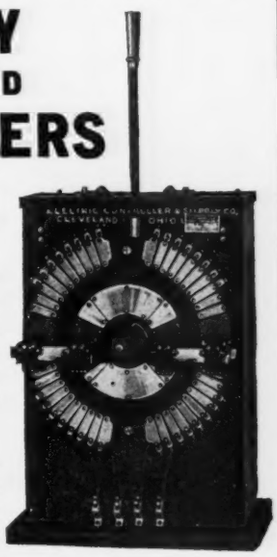

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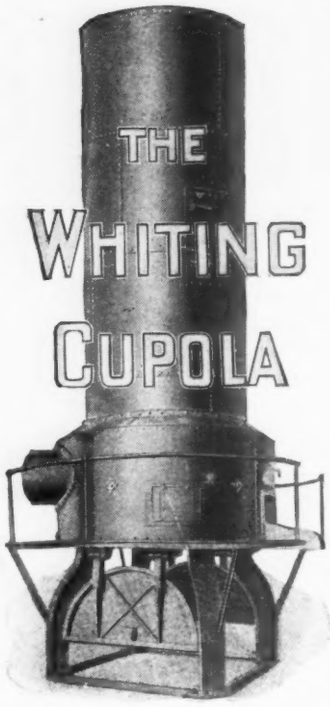

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